SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This section of the safety evaluation report (SER) contains the staff's evaluation of the applicant's aging management programs (AMPs) and aging management reviews (AMRs). In Appendix B to its license renewal application (LRA), the applicant described the 35 AMPs that it relies on to manage or monitor the aging of long-lived, passive structures and components (SCs).

In LRA Section 3, the applicant provided the results of the AMRs for those SCs that it identified in LRA Section 2 as being within the scope of license renewal and subject to an AMR.

3.0 Applicant's Use of the Generic Aging Lessons Learned Report

In preparing its LRA, Nuclear Management Company, LLC (NMC or the applicant), credited NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," issued July 2001. The GALL Report contains the staff's generic evaluation of the existing plant programs, and it documents the technical basis for determining when existing programs are adequate without modification, and when existing programs should be augmented for the extended period of operation. The evaluation results documented in the GALL Report indicate that many of the existing programs are adequate to manage the aging effects for particular SCs for license renewal without change. The GALL Report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. An applicant may reference the GALL Report in its LRA to demonstrate that the programs at its facility correspond to those reviewed and approved in the report.

The GALL Report provides a summary of staff-approved AMPs to manage or monitor the aging of SCs that are subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources used to review an applicant's LRA will likely be reduced, thereby improving the efficiency and effectiveness of the license renewal review process. The GALL Report also serves as a reference for applicants and staff reviewers to quickly identify those AMPs and activities that the staff has determined will adequately manage or monitor aging during the period of extended operation.

The GALL Report identifies (1) systems, structures, and components (SSCs), (2) SC materials, (3) the environments to which the SCs are exposed, (4) the aging effects associated with the given materials and environments, (5) the AMPs that are credited with managing or monitoring the aging effects, and (6) recommendations for further applicant evaluations of aging management for certain component types.

The staff performed its review in accordance with the requirements of Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," of the *Code of Federal Regulations* (10 CFR Part 54), the guidance provided in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), issued July 2001, and the guidance provided in the GALL Report.

In addition to its review of the LRA, the staff conducted an onsite audit of selected AMRs and associated AMPs, as described in the "Audit and Review Plan for Plant Aging Management Reviews and Programs for Monticello Nuclear Generating Plant," dated June 2, 2005. The staff designed its onsite audits and reviews to maximize the efficiency of its review of the LRA. This helps reduce the need for formal correspondence between the staff and the applicant, thereby improving the review's efficiency. In addition, the applicant could respond to questions and the staff could readily evaluate the applicant's responses.

3.0.1 Format of the License Renewal Application

The applicant submitted an application that followed the standard LRA format, which was agreed to by the U.S. Nuclear Regulatory Commission (NRC) staff and the Nuclear Energy Institute (NEI) (see letter dated April 7, 2003, ADAMS Accession No. ML030990052). This revised LRA format incorporates lessons learned from the staff's reviews of the previous five LRAs. These previous applications used a format developed from information gained during an NRC staff and NEI demonstration project that was conducted to evaluate the use of the GALL Report in the staff's review process.

The organization of LRA Section 3 parallels Chapter 3 of the SRP-LR. Two types of tables present the AMR results information in LRA Section 3:

(1) Table 1—Table 3.x.1, where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, and "1" indicates that this is the first table type in LRA Section 3.

(2) Table 2—Table 3.x.2-y, where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, "2" indicates that this is the second table type in LRA Section 3, and "y" indicates the system table number.

The content of previous applications for other plants' renewals and the Monticello Nuclear Generating Plant (MNGP) application is essentially the same. The revised format used for the MNGP application was intended to modify the tables in Section 3 to provide additional information that will assist the staff in its review. In Table 1, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In Table 2, the applicant identified the linkage between the scoping and screening results in Section 2 of the LRA and the AMRs in Section 3.

3.0.1.1 Overview of Table 1

Table 3.x.1 (Table 1) provides a summary comparison of how the facility aligns with the corresponding tables in the GALL Report, Volume 1. The table is essentially the same as Tables 1 through 6 provided in the GALL Report, Volume 1, except that the "Type" column has been replaced by an "Item Number" column and the "Item Number in GALL" column has been replaced by a "Discussion" column. The "Item Number" column provides the reviewer with a means to cross-reference from Table 2 to Table 1. The applicant used the "Discussion" column to provide clarifying and amplifying information. This column might contain the following types of information:

- further evaluation recommended (information or reference to the location of that information)
- the name of a plant-specific program being used
- *exceptions to the GALL Report assumptions*
- a discussion of how the line is consistent with the corresponding line item in the GALL Report when this may not be intuitively obvious
- a discussion of how the item is different from the corresponding line item in the GALL Report (e.g., when an exception is taken to an AMP that is listed in the GALL Report)

The format of Table 1 allows the staff to align a specific Table 1 row with the corresponding GALL Report, Volume 1, table row so that the consistency can be easily verified.

3.0.1.2 Overview of Table 2

Table 3.x.2-y (Table 2) provides the detailed results of the AMRs for those components identified in LRA Section 2 as subject to an AMR. The LRA contains a Table 2 for each of the systems or components within a system grouping (e.g., reactor coolant system (RCS), engineered safety features (ESFs), and auxiliary systems). For example, the ESF group contains tables specific to the core spray (CSP) system, high-pressure coolant injection (HPC) system, and residual heat removal (RHR) system,. Table 2 consists of the following nine columns:

(1) Component Type—The first column identifies the component types from LRA Section 2 that are subject to an AMR. The table lists the component types in alphabetical order.

(2) Intended Function—The second column contains the license renewal intended functions for the listed component types. LRA Table 2.1-1 contains definitions of intended functions.

(3) Material—The third column lists the particular materials of construction for the component type.

(4) Environment—The fourth column lists the environment to which the component types are exposed. The column indicates the internal and external service environments; LRA Table 3.0-1 lists these environments.

(5) Aging Effect Requiring Management (AERM)—The fifth column lists aging effects requiring management. As part of the AMR process, the applicant determined any AERMs for each combination of material and environment.

(6) AMPs—The sixth column lists the AMPs that the applicant used to manage the identified aging effects.

(7) NUREG-1801 Volume 2 Line Item—The seventh column lists the GALL Report item(s) that the applicant identified as being similar to the AMR results in the LRA. The applicant compared each combination of component type, material, environment, AERM, and AMP in LRA Table 2 to the items in the GALL Report. If the GALL Report contained no corresponding items, the applicant left the column blank. In this way, the applicant identified the AMR results in the LRA tables that correspond to the items in the GALL Report tables.

(8) Table 1 Item—The eighth column lists the corresponding summary item number from Table 1. If the applicant identified AMR results in Table 2 that are consistent with the GALL Report, then Table 2 should list the associated Table 3.x.1 line summary item number. If the GALL Report contains no corresponding item, then the applicant left the eighth column blank. In this way, the information from the two tables can be correlated.

(9) Notes—The ninth column lists the corresponding notes that the applicant used to identify how the information in Table 2 aligns with that in the GALL Report. An NEI working group developed the notes identified by letters, which will be used in future LRAs. Any plant-specific notes are identified by a number and provide additional information concerning the consistency of the line item with the GALL Report.

3.0.2 Staff's Review Process

The staff conducted the following three types of evaluations of the AMRs and associated AMPs:

(1) For items that the applicant stated were consistent with the GALL Report, the staff conducted either an audit or a technical review to determine consistency with the GALL Report.

(2) For items that the applicant stated were consistent with the GALL Report with exceptions and/or enhancements, the staff conducted either an audit or a technical review of the item to determine consistency with the GALL Report. In addition, the staff conducted either an audit or a technical review of the applicant's technical justification for the exceptions and the adequacy of the enhancements.

(3) For other items, the staff conducted a technical review per 10 CFR 54.21(a)(3).

The staff performed audits and technical reviews of the applicant's AMPs and AMRs. These audits and technical reviews determine whether the effects of aging on SCs can be adequately managed so that their intended functions can be maintained consistent with the plant's current licensing basis (CLB) for the period of extended operation, as required by 10 CFR Part 54.

3.0.2.1 Review of AMPs

For those AMPs for which the applicant claimed consistency with the GALL Report AMPs, the staff conducted either an audit or a technical review to verify that the applicant's AMPs were consistent with the AMPs in the GALL Report. For each AMP that had one or more deviations, the staff evaluated each deviation to determine (1) whether the deviation is acceptable and (2) whether the AMP, as modified, will adequately manage the aging effect(s) for which it is credited. For AMPs that the GALL Report, the staff performed a full review to determine the adequacy of the AMPs. The staff evaluated the AMPs against the following 10 program elements defined in SRP-LR Appendix A:

(1) Scope of the Program—Scope of the program should include the specific SCs subject to an AMR for license renewal.

(2) Preventive Actions—Preventive actions should prevent or mitigate aging degradation.

(3) Parameters Monitored or Inspected—Parameters monitored or inspected should be linked to the degradation of the particular SC intended function(s).

(4) Detection of Aging Effects—Detection of aging effects should occur before there is a loss of SC intended function(s). This element includes aspects such as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new/one-time inspections to ensure the timely detection of aging effects.

(5) Monitoring and Trending—Monitoring and trending should provide predictability of the extent of degradation, as well as timely corrective or mitigative actions.

(6) Acceptance Criteria—Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.

(7) Corrective Actions—Corrective actions, including root cause determination and prevention of recurrence, should be timely.

(8) Confirmation Process—The confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

(9) Administrative Controls—Administrative controls should provide a formal review and approval process.

(10) Operating Experience—Operating experience of the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the SC intended function(s) will be maintained during the period of extended operation.

The "Audit and Review Report for Plant Aging Management Reviews and Programs Monticello Nuclear Generating Plant," dated October 12, 2005 (hereafter referred to as the MNGP audit and review report), details the staff's audit evaluation of program elements (1) through (6), as summarized in SER Section 3.0.3.

The staff reviewed the applicant's Corrective Action Program (CAP) and documented its evaluations in SER Section 3.0.4. The staff's evaluation of the CAP included assessment of the Corrective Actions, Confirmation Process, and Administrative Controls program elements.

The staff reviewed the information concerning the Operating Experience program element and documented its evaluation in the MNGP audit and review report. The staff also included a summary of the program in SER Section 3.0.3.

The staff reviewed the Updated Safety Analysis Report (USAR) supplement for each AMP to determine if it adequately describes the program or activity, as required by 10 CFR 54.21(d).

3.0.2.2 Review of AMR Results

LRA Table 2 contains information concerning whether the applicant's AMRs align with the AMRs identified in the GALL Report. For a given AMR in Table 2, the staff reviewed the intended function, material, environment, AERM, and AMP combination for a particular component type within a system. The applicant identified the AMRs that correlate between a combination in Table 2 and a combination in the GALL Report using a referenced item number in the seventh column, "NUREG-1801 Volume 2 Line Item." The staff also conducted onsite audits to verify the correlation. A blank seventh column indicates that the applicant could not locate an appropriate corresponding combination in the GALL Report. The staff conducted a technical review of these combinations that were not consistent with the GALL Report. The next column, "Table 1 Item," provides a reference number that indicates the corresponding row in Table 1.

3.0.2.3 USAR Supplement

Consistent with the SRP-LR, for the AMRs and associated AMPs that it reviewed, the staff also reviewed the USAR supplement that summarizes the applicant's programs and activities for managing the effects of aging for the period of extended operation, as required by 10 CFR 54.21(d).

3.0.2.4 Documentation and Documents Reviewed

In performing its review, the staff relied heavily on the LRA, the LRA supplements, the SRP-LR, and the GALL Report.

In addition, during the onsite audit, the staff examined the applicant's justification, as documented in the staff's MNGP audit and review report, to verify that the applicant's activities and programs will adequately manage the effects of aging on SCs. The staff also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others with technical expertise relevant to aging management.

3.0.3 Aging Management Programs

Table 3.0.3-1 presents the AMPs credited by the applicant and described in LRA Appendix B. The table also indicates the GALL Report program that the applicant claimed its AMP was consistent with (if applicable) and the SSCs for managing or monitoring aging. Finally, the table provides the section of the SER that documents the staff's evaluation of the program.

Table 3.0.3-1 MNGP's Aging Management Programs

MNGP AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Existing AMPs				
10 CFR 50, Appendix J Program (B2.1.1)	Consistent with exceptions	XI.S4	containments, structures, and component supports	3.0.3.2.1
ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)	Consistent with exception	XI.M1	reactor coolant system, engineered safety features	3.0.3.2.2

MNGP AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
ASME Section XI, Subsection IWF Program (B2.1.3)	Consistent with enhancement	XI.S3	containments, structures, and component supports	3.0.3.2.3
Bolting Integrity Program (B2.1.4)	Consistent with enhancements	XI.M18	reactor coolant system, engineered safety features, auxiliary systems, steam and power conversion system, containment, structures, and component supports	3.0.3.2.4
Buried Piping & Tanks Inspection Program (B2.1.5)	Consistent with enhancements	XI.M34	engineered safety features; auxiliary systems; containments, structures, and component supports	3.0.3.2.5
BWR Control Rod Drive Return Line Nozzle Program (B2.1.7)	Consistent with exceptions	XI.M6	reactor coolant system	3.0.3.2.6
BWR Feedwater Nozzle Program (B2.1.8)	Consistent with enhancements	XI.M5	reactor coolant system	3.0.3.2.7
BWR Penetrations Program (B2.1.9)	Consistent with exceptions	XI.M8	reactor coolant system	3.0.3.2.8
BWR Stress Corrosion Cracking Program (B2.1.10)	Consistent with exception	XI.M7	reactor coolant system, engineered safety features, auxiliary systems	3.0.3.2.9
BWR Vessel ID Attachment Welds Program (B2.1.11)	Consistent with exception	XI.M4	reactor coolant system	3.0.3.2.10
BWR Vessel Internals Program (B2.1.12)	Consistent with exception and enhancement	XI.M9	reactor coolant system	3.0.3.2.11
Closed-Cycle Cooling Water System Program (B2.1.13)	Consistent with exceptions and enhancement	XI.M21	reactor coolant system, engineered safety features, auxiliary systems	3.0.3.2.12
Compressed Air Monitoring Program (B2.1.14)	Consistent with exceptions and enhancements	XI.M24	auxiliary systems	3.0.3.2.13
Fire Protection Program (B2.1.17)	Consistent with exception and enhancement	XI.M26	auxiliary systems; containments, structures, and component supports	3.0.3.2.15
Fire Water System Program (B2.1.18)	Consistent with enhancement	XI.M27	auxiliary systems	3.0.3.2.16

MNGP AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Flow-Accelerated Corrosion Program (B2.1.19)	Consistent	XI.M17	reactor coolant system, engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.1.2
Fuel Oil Chemistry Program (B2.1.20)	Consistent with exceptions and enhancements	XI.M30	auxiliary systems	3.0.3.2.17
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B2.1.22)	Consistent with exception and enhancements	XI.M23	containments, structures, and component supports	3.0.3.2.18
Open-Cycle Cooling Water System Program (B2.1.24)	Consistent	XI.M20	engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.1.5
Plant Chemistry Program (B2.1.25)	Consistent with exceptions	XI.M2	reactor coolant system, engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.2.19
Primary Containment In-Service Inspection Program (B2.1.26)	Consistent	XI.S1	containments, structures, and component supports	3.0.3.1.6
Protective Coating Monitoring & Maintenance Program (B2.1.27)	Consistent with enhancement	XI.S8	containments, structures, and component supports	3.0.3.2.20
Reactor Head Closure Studs Program (B2.1.28)	Consistent with exceptions	XI.M3	reactor coolant system	3.0.3.1.7
Reactor Vessel Surveillance Program (B2.1.29)	Consistent with enhancement	XI.M31	reactor coolant system	3.0.3.2.21
Structures Monitoring Program (B2.1.31)	Consistent with enhancements	XI.S6	containments, structures, and component supports	3.0.3.2.23
System Condition Monitoring Program (B2.1.32)	Plant-specific	NA	reactor coolant system; engineered safety features; auxiliary systems; steam and power conversion system; containments, structures, and component supports	3.0.3.3.2

MNGP AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B2.1.33)	Consistent	XI.M13	reactor coolant system	3.0.3.1.8
Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program (B3.1)	Consistent	X.E1	electrical and instrumentation and controls	3.0.3.1.9
Metal Fatigue of the Reactor Coolant Pressure Boundary Program (B3.2)	Consistent with enhancement	X.M1	reactor coolant system, engineered safety features	3.0.3.2.24
New AMPs				
Bus Duct Inspection Program (B2.1.6)	Plant specific	NA	electrical and instrumentation and controls	3.0.3.3.1
Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B2.1.15)	Consistent	XI.E1	electrical and instrumentation and controls	3.0.3.1.1
Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B2.1.16)	Consistent with exceptions	XI.E2	electrical and instrumentation and controls	3.0.3.2.14
Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program (B2.1.21)	Consistent	XI.E3	electrical and instrumentation and controls	3.0.3.1.3
One-Time Inspection Program (B2.1.23)	Consistent	XI.M32	reactor coolant system, engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.1.4

MNGP AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Selective Leaching of Materials Program (B2.1.30)	Consistent with exception	XI.M33	engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.2.22

3.0.3.1 AMPs That Are Consistent with the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as consistent with the GALL Report:

- Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program (B2.1.15)
- Flow-Accelerated Corrosion (FAC) Program (B2.1.19)
- Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program (B2.1.21)
- One-Time Inspection Program (B2.1.23)
- Open-Cycle Cooling Water (OCCW) System Program (B2.1.24)
- Primary Containment In-Service Inspection Program (B2.1.26)
- Reactor Head Closure Studs Program (B2.1.28)
- Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B2.1.33)
- Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements Program (B3.1)

3.0.3.1.1 Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. In LRA Section B2.1.15, the applicant described the Electrical Cables & Connections Not Subject to 10 CFR 50.49 EQ Requirements Program, stating that this new program is consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the component. An adverse variation in environment is significant if it could appreciably increase the rate of aging of a component or have an immediate adverse effect on operability. In most areas of the plant, the actual ambient environments (e.g., temperature, radiation, or moisture) are less severe than the plant design environment. However, in a limited number of localized areas, the actual environments may be more severe than the plant design environment for those areas. Cable and connection insulation materials may degrade more rapidly than expected in these adverse localized environments. Since they are not subject to the EQ requirements of 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," the electrical cables and connections covered by this AMP are either not exposed to harsh accident conditions or not required to remain functional during or following an accident to which they are exposed. The scope of this program includes accessible non-EQ electrical cables and connections, including control and instrumentation circuits, within the scope of license renewal.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report documents the details of the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.E1.

The staff reviewed those portions of AMP B2.1.15, "Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," which the applicant claims are consistent with GALL AMP XI.E1, "Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," and found them consistent with the GALL Report AMP. Because it is consistent with the GALL Report, the AMP ensures that the effects of aging will be adequately managed. The staff found the applicant's LRA AMP acceptable because it conforms to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.15, the applicant explained that the Electrical Cables & Connections Not Subject to 10 CFR 50.49 EQ Requirements Program is a new site-specific program and therefore does not have any operating experience. However, as noted in the GALL Report, industry operating experience shows that adverse local environments caused by heat or radiation for electrical cables and connections have been shown to exist and produce degradation of insulating material degradation that can be detected visually.

During the audit and review, the staff asked the applicant how it captures operating experience. The applicant stated that the site's CAP identifies, tracks, and trends site operating experience related to all site components. It documents any site component identified as degraded, failed, or potentially unable to fulfill its intended functions in the site CAP database. The plant engineering staff then evaluates these components for the extent of the condition and takes appropriate followup actions. The plant engineering staff also trends related CAPs to identify generic issues and addresses trended site issues in program health reports presented to site management on a scheduled basis. The CAP also addresses issues related to 10 CFR 54.21, "Contents of Application—Technical Information," and external operating events reported by the NRC, Institute of Nuclear Power Operations (INPO), Licensing Information Service (LIS), and NMC Fleet. The staff reviewed the applicant's response and found it acceptable.

The staff recognized that the CAP, which captures internal and external operating experience issues, will ensure that the licensee reviews and incorporates operating experience in the future.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.15, the applicant provided the USAR supplement for the Electrical Cables & Connections Not Subject to 10 CFR 50.49 EQ Requirements Program.

Subsequently, by letter dated June 10, 2005, the applicant revised its USAR supplement to include the following commitment, documented as commitment 26 in Table A.5:

> Prior to the period of extended operation, the MNGP Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will be implemented as a new program consistent with the recommendations of NUREG-1801 Chapter XI Program XI.E1. The program will manage the aging of conductor insulation material on cables, connectors, and other electrical insulation materials that are installed in an adverse localized environment caused by heat, radiation, or moisture.

The staff reviewed this section and determined that the information in the USAR supplement as augmented by the commitment adequately describes the program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Electrical Cables & Connections Not Subject to 10 CFR 50.49 EQ Requirements Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. In LRA Section B2.1.19, the applicant described the Flow-Accelerated Corrosion (FAC) Program, stating that this existing program is consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion." The program implements the Electric Power Research Institute (EPRI) guidelines in NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program." This program also requires the use of CHECWORKS as a predictive tool. The program includes (1) an analysis to determine locations susceptible to flow-accelerated corrosion (FAC), (2) performance of limited baseline inspections, (3) followup inspections to confirm the predictions, and (4) repairing or replacing components, as necessary. The MNGP FAC Program includes the response made to Generic Letter (GL) 89-08, "Erosion/Corrosion Induced Pipe Wall Thinning, dated May 2, 1989."

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M17.

During the audit and review, the staff asked the applicant to clarify the minimum allowable wall thickness defined in the MNGP FAC program. The applicant stated that if degradation is detected such that the measured wall thickness is less than 87.5 percent of nominal wall thickness for safety-related (SR) piping or 60 percent of nominal wall thickness for nonsafety-related (NSR) piping, it will perform an engineering evaluation to determine whether the degraded component is acceptable for continued use. If the component requires repair or replacement during the inspection outage, the applicant will initiate a condition report (CR)/action request (AR) in accordance with the site-specific CAP. If a replacement is planned for the next refueling outage, the applicant will initiate a work request in accordance with the site-specific process for work requests/work orders (WOs). In addition to the engineering evaluation, the applicant will examine adjacent areas to bound the thinning and assure that the actual minimum wall thickness is measured.

The applicant further evaluated the adequacy of using 60 percent of pipe nominal wall thickness as a trigger point for an engineering evaluation of NSR piping. The applicant determined that the 60-percent criterion has technical merit in statistical analysis, but lacks rigorous justification because the applicant has not performed any plant-specific analysis to ensure its validity for all cases at MNGP. By letter dated August 11, 2005, the applicant provided responses to questions raised during the AMP and AMR audits. In this letter, the applicant committed to revise its FAC Inspection Program to use the industry-accepted 87.5 percent of nominal pipe wall thickness for NSR piping as a trigger point for an engineering evaluation. The applicant identified this as commitment 53 in Table A.5 of the USAR supplement provided in its letter dated March 15, 2006. On the basis of its review, the staff found the applicant's response acceptable because it adequately addressed the minimum wall thickness evaluation.

The staff reviewed those portions of the MNGP AMP B2.1.19, "Flow-Accelerated Corrosion Program," that the applicant claimed are consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion," and found them consistent with the GALL Report AMP. Because it is consistent with the GALL Report, the AMP ensures that the effects of aging will be adequately managed. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.19, the applicant explained that the FAC wall thinning problems in single-phase systems have occurred throughout the industry in feedwater (FW) and condensate systems, and in two-phase piping in extraction steamlines and moisture separator reheater and FW heater drains. Application of the program at MNGP has resulted in the identification and replacement of susceptible piping sections with materials more resistant to FAC (e.g., extraction steam system piping and piping downstream of the moisture separators). The NRC originally outlined the FAC program in NUREG-1344, "Erosion/Corrosion-Induced Pipe Wall Thinning in U.S. Nuclear Power Plants," issued 1989, and implemented it through GL 89-08. The MNGP program has evolved through industry experience and is now implemented using the guidelines of NSAC-202L-R2 and CHECWORKS as a predictive tool. Monitoring locations and inspection methods have improved over time based on industry and plant experience and through the development of new techniques.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's FAC Program will adequately manage the aging effects at the applicant's plant.

USAR Supplement. In LRA Section A2.1.19, the applicant provided the USAR supplement for the FAC Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's FAC Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3 Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program

Summary of Technical Information in the Application. In LRA Section B2.1.21, the applicant described the Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program, stating that this new program is consistent with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The intended function of insulated cables and connections is to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals. Most electrical cables at MNGP are located in dry environments. However, some cables may be exposed to condensation and wetting in inaccessible locations, such as conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations. When an energized medium-voltage cable is exposed to wet conditions for which it was not designed, water treeing or a decrease in the dielectric strength of the conductor insulation can occur. This can potentially lead to electrical failure. In this AMP, the applicant takes periodic actions to prevent the exposure of cables to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined before the initial test, and it will be a proven test for detecting deterioration of the insulation system as a result of wetting, such as power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.E3.

During the audit and review, the staff asked that the applicant explain the process for assuring that cables in conduit are not subject to significant moisture and, thus, are not subject to testing. The applicant indicated that it is impossible to assure that cables in underground conduit are not exposed to significant moisture. The applicant further noted that the majority of its underground cables are buried without the use of conduit and are thus subject to significant moisture and required to be tested. Cables located in underground conduit are also subject to significant moisture from condensation and required to be tested. In addition, under the Parameters Monitored or Inspected program element, included as part of MNGP AMP B2.1.21, "Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements," the MNGP program will test medium-voltage cables (2 kilovolt (kV) to 34.5 kV) within the scope of license renewal exposed to moisture (direct buried or in underground conduit) and energized more than 25 percent of the time. The staff reviewed this response and found it acceptable.

In the course of its review, the staff noted the applicant's statement that, in the Preventive Actions program element, it takes periodic actions, like inspecting for water collection in cable manholes and conduit and draining water as needed, to prevent prolonged exposure of medium-voltage cables to significant moisture. In the LRA, the applicant stated the following:

> Medium voltage cables, for which such actions are taken, are not required to be tested since operating experience indicates that prolonged exposure to significant moisture and being energized for significant periods of time are required to induce this aging effect.

In Request for Additional Information (RAI) B2.1.21-1, dated November 7, 2005, the staff noted its position that inaccessible medium-voltage cables be tested and inspected. Therefore, the staff requested that the applicant remove the line from the LRA indicating that medium-voltage cables are not required to be tested. In addition, the staff requested that the applicant state the inspection frequency and its basis.

In its response, by letter dated December 7, 2005, the applicant stated that it will revise the Preventive Action program element in LRA Section B2.1.21 to delete the following text:

> Medium-voltage cables, for which such actions are taken, are not required to be tested since operating experience indicates that prolonged exposure to significant moisture and being energized for significant periods of time are required to induce this effect.

In its letter dated March 15, 2006, the applicant amended the Detection of Aging Effects program element by adding the following statement:

> In addition, the underground electrical vaults (manholes, handholes, etc) containing cable at MNGP are designed and installed without a concrete bottom. The electrical vaults are set on natural soil which is porous river sand. Historically, water accumulation in electrical vaults has not been an issue due to the natural draining of the porous soil. The inspection frequency for water collection will be based on actual plant experience. For those electrical vaults within the scope of license renewal, the initial inspection frequency for water accumulation will be at least once every two years. The first inspection for license renewal is to be completed before the period of extended operation.

Based on its review, the staff found the applicant's response to RAI B2.1.21-1 acceptable. The staff found that the applicant's response addresses the staff's concern regarding testing and inspection of water in manholes for inaccessible medium-voltage cables. Therefore, the staff's concern described in RAI B2.1.21-1 is resolved.

The staff reviewed those portions of MNGP AMP B2.1.21 that the applicant claimed are consistent with GALL AMP XI.E3 and found them consistent with the GALL Report AMP. Because it is consistent with the GALL Report, the AMP ensures that the effects of aging will be adequately managed. The staff found the applicant's LRA AMP acceptable because it conforms to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.21, the applicant explained that the Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program is a new program with no operating experience. However, as noted in the GALL Report, industry operating experience shows that cross-linked polyethylene or high-molecular weight polyethylene insulation materials are most susceptible to water tree formation. The formation and growth of water trees vary directly with operating voltage. Treeing is much less prevalent in 4-kV cables than those operated at 13-kV or 33-kV. Minimizing exposure to moisture also lessens the potential for the development of water treeing.

During the audit and review, the staff asked the applicant how it captures operating experience. The applicant indicated that the site's CAP identifies, tracks, and trends site operating experience related to all site components. The applicant documents any site component identified as degraded, failed, or potentially unable to fulfill its intended functions in the site CAP database. The plant engineering staff then evaluates these components for the extent of the condition and takes appropriate followup actions. The plant engineering staff also trends related CAPs to identify generic issues and addresses trended site issues in program health reports presented to site management on a scheduled basis. The CAP also addresses issues related to 10 CFR 54.21 and external operating events from the NRC, INPO, LIS, and NMC Fleet. The staff reviewed the applicant's response and found it acceptable.

The staff recognized that the CAP, which captures internal and external operating experience issues, will ensure that operating experience is reviewed and incorporated in the future.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.21, the applicant provided the USAR supplement for the Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program.

Subsequently, by letter dated June 10, 2005, the applicant revised its USAR supplement to include the following commitment, documented as commitment 36 in Table A.5:

> Prior to the period of extended operation, the MNGP Inaccessible Medium-Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ

Requirements Program will be implemented as a new program consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.E3.

The staff reviewed this section and determined that the information in the USAR supplement as augmented by the commitment adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 One-Time Inspection Program

Summary of Technical Information in the Application. In LRA Section B2.1.23, the applicant described the One-Time Inspection Program, stating that this new program is consistent with GALL AMP XI.M32, "One-Time Inspection." The MNGP One-Time Inspection Program addresses concerns with and confirmation for the potential long incubation period for certain aging effects on SCs. In some cases, (1) an aging effect is not expected to occur but data are not sufficient to completely rule it out, or (2) an aging effect is expected to progress very slowly. The activities of the One-Time Inspection Program include (1) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience, (2) identification of the inspection locations in the system or component based on the aging effect, (3) determination of the examination technique, including acceptance criteria that will be effective in managing the aging effect for which the component is examined, and (4) evaluation of the need for followup examinations to monitor the progression of any identified aging degradation. The program will manage the aging effects caused by corrosion, cracking, erosion, fouling, fretting, or thermal exposure. The program will also verify the absence of reduction of neutron absorption capacity of boral in the spent fuel pool.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M32.

The staff reviewed those portions of the MNGP AMP B2.1.23, "One-Time Inspection Program," that the applicant claimed are consistent with GALL AMP XI.M32 and found them consistent with the GALL Report AMP. Because it is consistent with the GALL Report, the AMP ensures that the effects of aging will be adequately managed. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.23, the applicant explained that the One-Time Inspection Program is a new program with no operating experience.

During the audit and review, the staff asked the applicant how it captures operating experience. The applicant indicated that the MNGP CAP identifies, tracks, and trends site operating experience related to all site components. The applicant documents any site component identified as degraded, as failed, or as potentially unable to fulfill its intended functions in the site CAP database. The plant engineering staff then evaluates these components for the extent of the condition and takes appropriate followup actions. The plant engineering staff also trends related CAPs to identify generic issues and addresses trended site issues in program health reports presented to site management on a scheduled basis. The CAP also addresses issues related to 10 CFR 54.21 and external operating events from the NRC, INPO, LIS, and NMC Fleet. The staff reviewed the applicant's response and found it acceptable.

The staff recognized that the CAP, which captures the internal and external operating experience issues, will ensure evaluation and incorporation of operating experience for objective evidence of the adequate management of aging effects.

USAR Supplement. In LRA Section A2.1.23, the applicant provided the USAR supplement for the One-Time Inspection Program.

Subsequently, by letter dated June 10, 2005, the applicant revised its USAR supplement to include the following commitment, documented as commitment 38 in Table A.5:

> Prior to the period of extended operation, the MNGP One-Time Inspection Program will be implemented as a new program consistent with the recommendations of NUREG-1801 Chapter XI Program XI.M32, "One-Time Inspection." This program will include measures to verify the effectiveness of the following aging management programs: Plant Chemistry Program and Fuel Oil Chemistry Program. This program will also confirm the absence of age related degradation in selected components (e.g., flow restrictors, venturis) within License Renewal scope.

The staff reviewed this section and determined that the information in the USAR supplement as augmented by the commitment adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's One-Time Inspection Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 Open-Cycle Cooling Water System Program

Summary of Technical Information in the Application. In LRA Section B2.1.24, the applicant described the Open-Cycle Cooling Water (OCCW) System Program, stating that this existing program is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System." The MNGP OCCW System Program relies on the implementation of the recommendations of NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," dated July 18, 1989, to ensure that the effects of aging on the raw water service water systems will be managed for the period of extended operation. This program manages the aging effects of metallic components in water systems (e.g., piping and heat exchangers) exposed to raw, untreated (e.g., service) water. Corrosion, erosion, and biofouling in SSCs serviced by the OCCW system cause these aging effects. The program includes (1) surveillance and control of biofouling, (2) tests to verify heat transfer, and (3) routine inspection and maintenance. The MNGP OCCW System Program complies with the MNGP response to NRC GL 89-13. The applicant has incorporated the commitments it made to comply with GL 89-13 into plant procedures and programs.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M20.

The staff reviewed those portions of the MNGP AMP B2.1.24, "Open-Cycle Cooling Water System Program," that the applicant claimed are consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System," and found them consistent with the GALL Report AMP. Because it is consistent with the GALL Report, the AMP ensures that the effects of aging will be adequately managed. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.24, the applicant explained that the OCCW System Program has been effective in managing loss of material and heat transfer degradation aging effects for systems within the scope of the program. Various self-assessments and Nuclear Oversight Department reviews have demonstrated program effectiveness and have shown that MNGP has implemented the requirements of GL 89-13. The applicant has documented and evaluated corrosion and material condition issues in the site CAP.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience, the staff concluded that applicant's OCCW System Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.24, the applicant provided the USAR supplement for the OCCW System Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's OCCW System Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Primary Containment In-Service Inspection Program

Summary of Technical Information in the Application. In LRA Section B2.1.26, the applicant described the Primary Containment In-Service Inspection Program, stating that this existing program is consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE." The MNGP Primary Containment In-Service Inspection Program requires visual examinations of the accessible surfaces (base metal and welds) of the drywell, torus, vent lines, internal vent system, penetration assemblies, and associated integral attachments. The program also requires examination of pressure-retaining bolting and the drywell interior slab moisture barrier. The program conforms to the applicable requirements of 10 CFR 50.55a, "Codes and Standards," and the 1992 Edition with 1992 Addenda of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), Subsection IWE. The applicant performs a detailed visual examination (VT)-3 and VT-1 examination once during each 10-year inservice inspection (ISI) interval. This examination occurs either at the end of the interval or is spread across the three periods that comprise the interval. The applicant performs general visual examinations that assess the overall structural condition once during each period. Surface and/or volumetric examination augments visual examination as required to define the extent of observed conditions or to identify deterioration at inaccessible locations. Limited scope examinations are performed as required to evaluate disassembled bolting and the condition of the normally submerged torus surface when the suppression pool is drained. The applicant periodically updates the program as required by 10 CFR 50.55a.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.S1.

The applicant stated in MNGP AMP B2.1.26, "Primary Containment In-Service Inspection Program," that exceptions to ASME Code requirements granted by approved code cases or relief requests are not considered exceptions to the GALL Report criteria. In addition, the discussions of some program elements cite a number of relief requests. In all cases, the applicant reiterated that these are not considered exceptions since the NRC reviewed the

MNGP IWE program and the program is in accordance with 10 CFR 50.55a with NRC-approved relief requests.

The staff noted that 10 CFR 54.21 requires the LRA to contain information for each SC within the scope of license renewal demonstrating that the applicant will adequately manage aging effects so that intended functions will be maintained consistent with the CLB for the period of extended operation. The staff questioned the applicant's position that exceptions to ASME Code requirements granted by code cases or relief requests are not considered exceptions to the GALL Report.

In its letter dated August 31, 2005, the applicant stated the following:

> The statement under the 'NUREG-1801 Consistency' regarding 'Exceptions to ASME Code requirements that have been granted by approved Code Cases or relief requests are not considered to be exceptions to NUREG-1801 criteria' should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior to the period of extended operation.
>
> The statement under the 'Scope of Program' regarding 'These are not considered exceptions since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests' should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior to the period of extended operation.
>
> The statement under the 'Parameters Monitored or Inspected' regarding 'These are not considered exceptions since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests' should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior to the period of extended operation.
>
> The statement under the 'Detection of Aging Effects' regarding 'This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests' should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior to the period of extended operation.
>
> The statement under the 'Monitor and Trending' regarding 'This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests' should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior to the period of extended operation.
>
> The statement under the 'Corrective Actions' regarding 'This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests' should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior to the period of extended operation.

> The statement under the 'Confirmation Process' regarding 'This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests' should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior to the period of extended operation.

The staff found the applicant's position acceptable, because the applicant removed references stating that relief requests were not considered exceptions to the GALL Report and the relief requests will not be credited for aging management.

The staff reviewed those portions of the MNGP AMP B2.1.26 that the applicant claimed are consistent with GALL AMP XI.S1 and found them consistent with the GALL Report AMP. Because it is consistent with the GALL Report, the AMP ensures that the effects of aging will be adequately managed. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.26, the applicant explained that the Primary Containment In-Service Inspection Program, when implemented in conjunction with the 10 CFR 50, Appendix J Program and special examinations conducted to address specific industry issues, has demonstrated that aging of the primary containment, the internal vent system, and steel components within the torus is managed in an effective manner. Special examinations have verified the absence of significant corrosion in the drywell sand pocket region and on the normally submerged surfaces of the torus. The applicant also stated that leakage testing has been effective in early detection of passive isolation barrier deterioration (active barriers are outside the scope of the AMP). Examinations under the ISI program have shown that there is no significant corrosion on, or other deterioration of, accessible containment shell, vent system, and penetration assembly surfaces.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the Primary Containment In-Service Inspection Program will adequately manage the aging effects identified in the LRA for which the AMP is credited.

USAR Supplement. In LRA Section A2.1.26, the applicant provided the USAR supplement for the Primary Containment In-Service Inspection Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Primary Containment In-Service Inspection Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. In LRA Section B2.1.28, the applicant described the Reactor Head Closure Studs Program, stating that this existing program is consistent with GALL AMP XI.M3, "Reactor Head Closure Studs." The MNGP Reactor Head Closure Studs Program is part of the MNGP ASME Section XI In-Service Inspection Program. The Reactor Head Closure Studs Program is in accordance with the ASME Code, Section XI, 1995 Edition through the 1996 Addenda, and provides for condition monitoring of the reactor head closure stud bolting. Replacement reactor head studs available for use at MNGP include preventive measures described in Regulatory Guide (RG) 1.65, "Material and Inspection for Reactor Vessel Closure Studs," issued October 1973. The applicant updates the program periodically as required by 10 CFR 50.55a.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M3.

During the audit and review, the staff noted that the applicant stated the following in LRA Section B2.1.28:

> Exceptions to ASME requirements that have been granted by approved Code Cases or relief requests are not considered to be exceptions to NUREG-1801 criteria.

The staff asked that the applicant clarify this statement. The applicant responded that it used Code Case N-307-2, "Revised Ultrasonic Examination Volume for Class 1 Bolting, Table IWB-2500-1, Examination Category B-G-1, When the Examinations Are Conducted From the End of the Bolt or Stud or From the Center-Drilled Hole," dated September 24, 1999, that applied to the reactor head closure studs. The applicant also used the ASME Code, Section XI, 2001 edition, in lieu of the 1995 edition with addenda through 1996, for repair and replacement activities; the staff discusses this second exception below. Code users employ code cases when they cannot or do not want to perform a particular code requirement. This is an allowed exception to the application of the code by the user and thus is an exception to GALL Report recommendations. The staff determined that the code case used affected the GALL Report recommendation and that its use constituted an exception. In its letter dated August 11, 2005, supplemented by its letter dated August 31, 2005, the applicant stated that it will change its application to identify the use of the code case as an exception to this AMP. The following provides the staff evaluation of these exceptions.

Exception 1: The GALL Report identifies the following recommendation for the Parameters Monitored or Inspected program element associated with the exception:

> The ASME Section XI ISI program detects and sizes cracks, detects loss of material, and detects coolant leakage by following the examination and inspection requirements specified in Table IWB-2500-1.

In its letter dated August 11, 2005, the applicant stated that when conducting ultrasonic testing (UT) examinations from the end of the stud to satisfy ASME Code, Section XI, examination requirements, the examination volume may be limited to a cylinder of 1/4-inch thickness measured from the minor diameter and the length of the threaded portion of the stud.

The staff confirmed that Table 1 of RG 1.147, Revision 13, "In-Service Inspection Code Case Acceptability, ASME Section XI, Division 1," issued January 2004, lists Code Case N–307-2. Based on this listing, the NRC staff has reviewed this code case and accepted it for general industry use.

The staff then reviewed both the applicable ASME Code, Section XI ISI requirements for the reactor head closure studs and the alternative requirements of Code Case N-307-2. ASME Code, Section XI, requires a visual examination of the surfaces of the reactor head closure nuts, washers, and bushings; a volumetric examination of the vessel flange threads and reactor head closure stud when examined in place; and a surface and volumetric examination of the reactor head closure stud when removed. In lieu of the volumetric examination required by ASME Code, Section XI, of essentially the entire volume of the reactor head closure stud, Code Case N-307-2 allows examination of a cylindrical region of 1/4-inch thickness measured from the minor diameter of the reactor head closure stud and the length of the threaded portion of the stud. The staff noted that the use of this code case reduces the required examination volume to the higher stress area of the bolting. The roots of the threads are stress risers and, hence, likely sites for crack initiation. Cracks at the roots of threads will be perpendicular to straight beam UT examination from the end of the stud and will create a corner trap for angle beam UT examination from the center hole. The staff reviewed the difference between the two requirements and noted that the use of the code case alters the portion of the stud examined but continues to identify relevant aging effects (i.e., cracking and general corrosion) as the high-stress portion of the stud continues to be examined. Thus, the staff determined that the applicant's use of the code case has no impact on the aging effect being managed.

On the basis of a review of the above exception and of operating experience for AMP B2.1.28, "Reactor Head Closure Studs Program," the staff found this exception acceptable.

<u>Exception 2</u>: The GALL Report identified the following recommendation for the Corrective Actions program element associated with the exception:

> Repair and replacement are in conformance with the requirements of IWB-4000 and IWB-7000, respectively, and the material and inspection guidance of RG 1.65.

In its letter dated August 11, 2005, the applicant stated that the staff has already generically reviewed and approved the use of the ASME Code, Section XI, 2001 edition, as an alternative to the 1995 edition with 1996 addenda, for repair and replacement for aging management of systems and components within the scope of license renewal. Therefore, this alternative will not affect the aging management of components crediting ISI performed in accordance with ASME Code, Section XI. The applicant provided the following justification, published in Volume 69 of the *Federal Register*, pages 58804 and 58816 on October 1, 2004, accompanying the NRC's amendments to its regulations that incorporated, by reference, certain updated editions and addenda of the ASME Code for use by NRC licensees:

> Accordingly, an applicant may use Subsections IWB, IWC, IWD, IWE, IWF, and IWL of Section XI of the ASME BPV Code (2001 Edition and the 2002 and 2003 Addenda) as acceptable alternatives to the requirements of the 1995 Edition up to and including the 1996 Addenda of the ASME Code, Section XI referenced in the GALL AMPs without the need to submit these alternatives for NRC review in its plant-specific license renewal application.

Because the NRC staff has already reviewed and approved this alternative, related to repair and replacement, generically for aging management of systems and components within the scope of license renewal, the staff concluded that it does not need to be classified as an exception and that the affected program element is consistent with the GALL Report.

Exception 3: The GALL Report identified the following recommendations for the Scope of Program element associated with the exception:

> The program includes preventive measures of NRC Regulatory Guide 1.65 to mitigate cracking. The program is applicable to closure studs and nuts constructed from materials with a maximum tensile strength limited to less than 1172 MPa (170 ksi) (Nuclear Regulatory Commission [NRC] Regulatory Guide [RG] 1.65).

The inspectors noted that RG 1.65 recommends that reactor head closure stud material measured ultimate tensile strength not exceed 170 kilo-pounds per square inch (ksi) to minimize the likelihood of stress-corrosion cracking (SCC). Hardness tests conducted on the installed reactor head studs showed that most studs have greater than 170 ksi tensile stress. The applicant committed to document this exception to NUREG-1801 in the LRA. In its letter dated March 15, 2006, the applicant stated the following:

> The Reactor Head Closure Studs Program does not incorporate the ultimate tensile strength requirement of NRC Regulatory Guide 1.65 for the existing reactor head closure studs. NMC considers this an acceptable exception to NUREG-1801, since these studs are considered susceptible to cracking at MNGP and NMC continues to manage them through the preventative measures recommended by Regulatory Guide 1.65 regardless of the tensile strength.

The inspectors found this exception to the GALL Report acceptable because the applicant considers these studs to be susceptible to cracking, continues to manage the studs using the other preventive measures of RG 1.65, continues to conduct UT and surface examinations on a 10- year interval, and, to date, has identified no apparent discontinuities.

The staff reviewed those portions of AMP B2.1.28 that the applicant claimed are consistent with GALL AMP XI.M3 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions described.

Operating Experience. In LRA Section B2.1.28, the applicant explained that the Reactor Head Closure Studs Program has been effective in managing the aging effects of reactor pressure vessel (RPV) closure studs. The applicant has considered plant operating experience in the evaluation of stud performance. The MNGP inspection and testing methodologies have detected no cracking, nondestructive examination (NDE) indications, or aging effects for the RPV studs. Intergranular SCC (IGSCC) was seen in two RPV head studs at another plant. In response to this incident, MNGP performed field hardness testing and UT examination of the reactor head studs removed from the reactor cavity during the 1991 outage, evaluated the test results, and evaluated the original certified material test reports. It found no evidence of RPV head stud cracking.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Reactor Head Closure Stud Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.28, the applicant provided the USAR supplement for the Reactor Head Closure Studs Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Reactor Head Closure Studs Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

Summary of Technical Information in the Application. In LRA Section B2.1.33, the applicant described the Thermal Aging & Neutron Irradiation Embrittlement of CASS Program, stating that this existing program is consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)." The MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program monitors the aging effects of loss of fracture toughness on the intended function of the component by performing examinations on CASS reactor vessel internal components as part of the MNGP ASME Section XI In-Service Inspection Program. The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is in accordance with ASME Code, Section XI, Subsection IWB, Category B—1 and B—2 requirements, and provides for condition monitoring of the CASS components. The applicant performs additional enhanced visual inspections that incorporate the requirements of the Boiling Water Reactor Vessel and Internals Project (BWRVIP) to detect the effects of loss of fracture toughness due to thermal aging and neutron irradiation embrittlement of CASS reactor vessel internals. The applicant updates the program periodically as required by 10 CFR 50.55a.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M13.

During the audit and review, the staff questioned the applicant regarding the screening criteria for determining the susceptibility of CASS components to thermal aging. The applicant stated that it does not address this screening process; instead, the program includes all CASS reactor vessel internal components. These components consist of jet pump assembly castings, the orifice fuel support casting, and the guide tube base casting. The staff found this approach conservative and therefore acceptable.

During the audit and review, the staff asked the applicant whether its current approved ISI relief requests or code cases affect any of its AMP program elements. In its letter dated August 31, 2005, the applicant identified the following exception to the GALL Report program element.

Exception: The GALL Report identifies the following recommendations for the Corrective Actions program element associated with the exception taken:

> Repair is in conformance with IWA-4000 and IWB-4000, and replacement is in accordance with IWA-7000 and IWB-7000.

In its letter dated August 11, 2005, the applicant stated that an approved alternative allows the use of the ASME Code, Section XI, 2001 edition in lieu of the 1995 edition with the 1996 addenda for repair/replacement activities. Section 3.0.3.1.7 of the SER provides the staff's evaluation of this exception.

Because the NRC has already reviewed and approved this alternative, relating to repair and replacement, generically for aging management of systems and components within the scope of license renewal, the staff concluded that it does not need to be classified as an exception and that, with regard to this item, the affected program element is consistent with the GALL Report.

The staff reviewed those portions of AMP B2.1.33, "Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program," that the applicant claimed are consistent with GALL AMP XI.M13 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exception described.

Operating Experience. In LRA Section B2.1.33, the applicant explained that the Thermal Aging & Neutron Irradiation Embrittlement of CASS Program has been effective in managing aging effects due to thermal aging and neutron irradiation embrittlement. The applicant periodically examines materials within the scope of the program and evaluates them for corrective action as needed. In addition to ASME inspection requirements, the applicant follows vendor guidance (e.g., BWRVIP-03, "BWR Vessel and Internals Project, Reactor Pressure Vessel and Internals Examination Guidelines," and BWRVIP-41, "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines").

In addition, the staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Thermal Aging & Neutron Irradiation Embrittlement of CASS Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.33, the applicant provided the USAR supplement for the Thermal Aging & Neutron Irradiation Embrittlement of CASS Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Thermal Aging & Neutron Irradiation Embrittlement of CASS Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements Program

Summary of Technical Information in the Application. In LRA Section B3.1, the applicant described the Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements Program, stating that this existing program that is consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components." The purpose of the MNGP EQ program is to ensure that SR electrical equipment is capable of performing its function in a harsh environment (effects of a loss-of-coolant accident (LOCA), high-energy line break (HELB), or post-LOCA radiation) and is qualified in accordance with the Equipment Qualification Final Rule, 10 CFR 50.49, dated February 22, 1983. This program describes EQ program attributes, and how those attributes ensure that the EQ program remains effective throughout the license renewal period (60 years).

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's evaluation of this AMP. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's MNGP audit and review report, which assesses the consistency of the AMP elements with GALL AMP X.E1.

The staff reviewed those portions of AMP B3.1, "Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements Program," that the applicant claimed are consistent with GALL AMP X.E1 and found them consistent. Because it is consistent with the GALL Report, the AMP ensures that the effects of aging will be adequately managed. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP.

Operating Experience. In LRA Section B3.1, the applicant explained that the MNGP EQ program includes monitoring and assessment of industry information in order to assess its impact on EQ components at MNGP. The EQ Coordinator is responsible for reviewing the disposition of such information, as well as subsequent assignment of actions to be taken, and confirming that completion of the actions has satisfactorily addressed potential MNGP EQ aging issues. The following examples provide objective evidence that the MNGP EQ program is responsive to externally identified operating experience items as well as proactive in self-identification activities:

- An NRC safety system design inspection, conducted in March 2003, resulted in two green findings and four corrective actions.
- A nuclear oversight quality assurance (QA) assessment in June 2003 resulted in no findings.
- The 2001 internal self-assessment resulted in a determination of effective implementation, but noted specific areas needing improvement and additional recommendations for continued improvement.
- The applicant periodically performs program health reviews to measure the acceptability of the program and identify improvements as applicable in accordance with MNGP and NMC Fleet procedures.
- The applicant conducts operating experience reviews of EQ issues identified at other sites and processes these items through the CAP.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements Program will adequately manage the aging effects observed at the applicant's plant.

USAR Supplement. In LRA Section A4.1, the applicant provided the USAR supplement for the Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs That Are Consistent with the GALL Report with Exceptions or Enhancements

In LRA Appendix B, the applicant identified the following AMPs that are, or will be, consistent with the GALL Report, with exceptions or enhancements:

- 10 CFR 50, Appendix J Program (B2.1.1)
- ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)
- ASME Section XI, Subsection IWF Program (B2.1.3)
- Bolting Integrity Program (B2.1.4)
- Buried Piping & Tanks Inspection Program (B2.1.5)
- BWR Control Rod Drive (CRD) Return Line Nozzle Program (B2.1.7)
- BWR FW Nozzle Program (B2.1.8)
- BWR Penetrations Program (B2.1.9)
- BWR Stress Corrosion Cracking (SCC) Program (B2.1.10)
- BWR Vessel Inside Diameter (ID) Attachment Welds Program (B2.1.11)
- BWR Vessel Internals Program (B2.1.12)
- Closed-Cycle Cooling Water (CCCW) System Program (B2.1.13)
- Compressed Air Monitoring Program (B2.1.14)
- Electrical Cables Not Subject to 10 CFR 50.49 EQ Requirements Used in Instrumentation Circuits Program (B2.1.16)
- Fire Protection Program (B2.1.17)
- Fire Water System Program (B2.1.18)
- Fuel Oil Chemistry Program (B2.1.20)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B2.1.22)
- Plant Chemistry Program (B2.1.25)
- Protective Coating Monitoring & Maintenance Program (B2.1.27)
- Reactor Vessel Surveillance Program (B2.1.29)
- Selective Leaching of Materials Program (B2.1.30)
- Structures Monitoring Program (B2.1.31)
- Metal Fatigue of the Reactor Coolant Pressure Boundary Program (B3.2)

For AMPs that the applicant claimed are consistent with the GALL Report, with exceptions or enhancements, the staff performed an audit to confirm that those attributes or features of the program for which the applicant claimed consistency with the GALL Report are indeed consistent. The staff also reviewed the exceptions and enhancements to the GALL Report to determine whether they are acceptable and adequate. The following sections document the results of the staff's audit and reviews.

3.0.3.2.1 10 CFR 50, Appendix J Program

Summary of Technical Information in the Application. In LRA Section B2.1.1, the applicant described the 10 CFR 50, Appendix J Program, stating that this existing program is consistent, with exceptions, with GALL AMP XI.S4, "10 CFR Part 50, Appendix J." The MNGP 10 CFR 50, Appendix J Program specifies pneumatic pressure tests and visual examinations to verify the structural and leak-tight integrity of the primary containment. An overall (Type A) pressure test assesses the capacity of the containment to retain design-basis accident (DBA) pressure. This test also measures total leakage through the containment pressure-retaining boundary. Local (Type B & C) tests measure leakage through individual penetration isolation barriers. These barriers are maintained as required to keep overall and local leakage under technical specification (TS) and plant administrative limits. The applicant performs tests at intervals determined by the risk and performance factors applicable to each tested item in accordance with governing regulations and standards. Visual examinations are performed before each Type A test. The applicant also performs these examinations at least once during each containment ISI period in which no Type A test is conducted. The examinations are performed to detect corrosion and other types of deterioration on the accessible surfaces of the containment.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.S4.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.S4 in the GALL Report.

Exception 1: The GALL Report identifies the following recommendation for the Scope of Program element associated with the exception taken:

> The scope of the containment LRT program includes all pressure-retaining components. Two types of tests are implemented. Type A tests are performed to measure the overall primary containment integrated leakage rate which is obtained by summing leakage through all potential leakage paths including containment welds, valves, fittings, and components that penetrate containment. Type B tests are performed to measure local leakage rates across each pressure-containing or leakage-limiting boundary for containment penetrations. Type A and B tests described in 10 CFR Part 50, Appendix J, are acceptable

> methods for performing these LRTs. Leakage testing for containment isolation valves (normally performed under Type C tests), if not included under this program, is included under LRT programs for systems containing the isolation valves.

In the LRA, the applicant stated that main steam isolation valves (MSIVs) are tested at 25 pounds per square inch gauge (psig) instead of at an accident pressure of 42 psig. The applicant indicated that Section III.C.2 of Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires, in part, that Type C testing be performed at the peak calculated accident pressure, which for MNGP is 42 psig. The outboard MSIVs are tested by pressurizing the volume between the inboard and outboard valves. The inboard MSIVs at MNGP are angled (Y-pattern globe) in the main steamlines for better closure characteristics. A test pressure at the peak calculated accident pressure (42 psig) acting under the inboard valve disc could lift the disc off its seat and cause excessive leakage into the vessel. The NRC has approved Type C testing of these valves at a reduced pressure of 25 psig as part of a request for relief (letter from Darrell G. Eisenhut, NRC, to D.M. Musolf, NMC, dated June 3, 1984). The staff determined that the inboard valves are the same design as the valves evaluated by the NRC and that a test pressure alternative in the leakage test will have no impact on aging management. Therefore, the staff concluded that this exception is acceptable.

<u>Exception 2</u>: The GALL Report identifies the following recommendation for the Monitoring and Trending program element associated with the exception taken:

> Because the LRT program is repeated throughout the operating license period, the entire pressure boundary is monitored over time. The frequency of these tests depends on which option (A or B) is selected. With Option A, testing is performed on a regular fixed time interval as defined in 10 CFR Part 50, Appendix J. In the case of Option B, the interval for testing may be increased on the basis of acceptable performance in meeting leakage limits in prior tests. Additional details for implementing Option B are provided in NRC Regulatory Guide 1.163 and NEI 94-01, Rev. 0.

In the LRA, the applicant stated that the Type A test interval is extended, on a one-time basis, to 15 years, exceeding the 10-year interval limit in NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," issued March 1996. The applicant stated that MNGP is currently under Option B, "Performance-Based Requirement," of Appendix J to perform the Type A containment integrated leakage rate test. In accordance with Option B provisions and acceptable Type A test performance history, the Type A testing will occur at a frequency of 10 years. The most recent Type A test was in March 1993; thus, the applicant will have to perform the subsequent test no later than March 2003. Following general industry practice, the applicant submitted a request for a one-time test interval extension to 15 years based on a plant-specific, risk-based evaluation. The staff approved this request in a letter from L.M. Padovan, NRC, to D.L. Wilson, NMC, dated March 31, 2003; therefore, MNGP will have to perform one Type A test no later than March 2008, before the period of extended operation. The frequency of future Type A tests will be determined on the basis of the next Type A test results and the limit set forth in Appendix J, Option B.

The staff found that, in addition to the integrated leakage test, Type A test requirements include visual examination of the containment exterior and interior to detect conditions that might adversely affect structural integrity or leak tightness. The applicant performs an examination before each Type A test and between tests at nominal intervals of 40 months. Because MNGP followed its CLB in having a Type A test interval extended once to 15 years ending before the period of extended operation and the additional visual examination requirements are in place, the staff found this exception acceptable.

The staff reviewed those portions of the AMP B2.1.1, "10 CFR 50, Appendix J Program," that the applicant claimed are consistent with GALL AMP XI.S4 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions as described above.

Operating Experience. In LRA Section B2.1.1, the applicant explained that the 10 CFR 50, Appendix J Program tests conducted under the program have been effective principally in detecting developing leakage through containment isolation valves, which, as active components, are outside the scope of the AMP. Testing has also detected developing leakage in both an electrical penetration conductor seal and a hot piping penetration expansion bellows. The applicant corrected both of these conditions while the leakage was still small. MNGP is committed to the risk- and performance-based program defined by Option B of Appendix J". This approach uses plant- and industrywide operating experience as the bases for defining the performance and risk factors, which, in turn, are used to determine testing intervals. Using this approach enhances the effectiveness of the program as an aging management tool by concentrating testing and maintenance resources on components that have higher risk and/or a history of high leakage.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's 10 CFR 50, Appendix J Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.1, the applicant provided the USAR supplement for the 10 CFR 50, Appendix J Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's 10 CFR 50, Appendix J Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by

10 CFR 54.21(d).

3.0.3.2.2 ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program

Summary of Technical Information in the Application. In LRA Section B2.1.2, the applicant described the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, stating that this existing program is consistent, with exception, with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program is part of the MNGP ASME Section XI In-Service Inspection Program. This program is in accordance with the ASME Code, Section XI, 1995 edition through the 1996 addenda and is subject to the limitations and modifications of 10 CFR 50.55a. The program provides for condition monitoring of Class 1, 2, and 3 pressure-retaining components and their integral attachments. The applicant inspects Class 1 and 2 piping in accordance with the risk informed ISI (RI-ISI) program as described in the EPRI Topical Report (TR)-112657, Revision B-A, "Revised Risk Informed In-Service Inspection Evaluation Procedure." The NRC has approved the use of RI-ISI in a safety evaluation (SE) documented in an NRC letter dated July 24, 2002, "Monticello Nuclear Generating Plant—Risk Informed In-Service Inspection Program (TAC No. MB3819)." The applicant updates the program periodically as required by 10 CFR 50.55a. The Plant Chemistry Program augments this program where applicable.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M1.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M1 in the GALL Report.

Exceptions 1 and 2: The GALL Report recommends the following for the Scope of Program element associated with the exception taken:

> The ASME Section XI program provides the requirements for ISI, repair, and replacement. The components within the scope of the program are specified in Subsections IWB-1100, IWC-1100, and IWD-1100 for Class 1, 2, and 3 components, respectively, and include all pressure-retaining components and their integral attachments in light-water cooled power plants. The components described in Subsection IWB-1220, IWC-1220 and IWD-1220 are exempt from the examination requirements of Subsections IWB-2500, IWC-2500, and IWD-2500.

In the LRA, the applicant stated that, pursuant to 10 CFR 50.55a(b)(2)(xi), it uses the requirements of IWB-1220 in the 1989 edition of the ASME Code, Section XI, for Class 1 piping instead of the 1995 edition of the ASME Code, Section XI, with the 1996 addenda and that, pursuant to 10 CFR 50.55a(b)(2)(xxi)(B), reused CRD bolting must meet examination requirements for Table IWB-2500-1, Category B-G-2, Item B7.80, of the 1995 edition of the ASME Code, Section XI.

The staff determined that both of the items that the applicant identified as exceptions are, in fact, requirements codified in 10 CFR 50.55a and that the Scope of Program program element in the GALL Report mentions no specific ASME Code, Section XI, edition or addenda. The staff asked the applicant why it considered these items exceptions to the GALL Report. The applicant stated that it "conservatively" identified these items as exceptions solely because they are requirements not contained in the ASME Code, Section XI, 1995 edition through 1996 addenda identified in the GALL Report program description for this AMP. The applicant stated that these codified requirements result in inspections that otherwise will not be required by the 1995 edition through 1996 addenda of the ASME Code, Section XI. Because the items identified by the applicant are requirements codified in 10 CFR 50.55a and necessitate more stringent examinations than the ASME Code, Section XI, 1995 edition through 1996 addenda would otherwise call for, the staff found these exceptions acceptable.

During the audit and review, the staff asked the applicant whether its approved ISI relief requests or code cases affect any of the AMP elements. The applicant stated that code cases and relief requests for the MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, IWD, and IWF Program are valid for approximately 21 months into the period of extended operation and that the current inspection interval ends on May 31, 2012. In addition, the applicant provided results of its reevaluation of code cases and relief requests as documented in its letter dated August 31, 2005. That reevaluation identified six additional exceptions (Exceptions 3 through 8) to the GALL Report program elements. The following paragraphs describe and evaluate these additional exceptions to the GALL Report.

Exception 3: The GALL Report identifies the following recommendation for the Detection of Aging Effects program element associated with the exception taken:

> Category B-G-1 specifies volumetric examination of studs in place, from the top of the nut to the bottom of the flange hole; surface and volumetric examination of studs when removed; volumetric examination of flange threads; and visual VT-1 examination of the surfaces of nuts, washers, and bushings.

In its letter dated August 11, 2005, the applicant stated that its ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program includes implementation of Code Case N–307-2, which revises the UT examination volume for Class 1 bolting.

Table 1 of RG 1.147 lists Code Case N–307-2. The applicant categorized implementation of this code case as an exception to the GALL Report because the description of the Detection of Aging Effects program element in GALL Report AMP XI.M1 references ASME Code, Section XI, Table IWB-2500-1, Examination Category B-G-1. The applicant stated that the only Class 1 bolts at MNGP with center holes are the reactor head closure studs and the reactor recirculation (REC) pump bolts. The applicant also stated that provisions of this code case were added to Table IWB-2500-1, Figure IWB-2500-12, and Appendix VIII, Supplement 8, 1.1(c), to the 2000 addenda of the ASME Code, Section XI. The applicant stated that this code case changes the portion of the bolt evaluated but will still detect the presence of the relevant aging effect. Because this code case only changes the portion of the component examined and continues to examine all applicable components in a way that will detect relevant aging effects, the staff concluded that this exception to the GALL Report is acceptable.

Exception 4: The GALL Report identifies the following recommendation for the Monitoring and Trending program element associated with the exception taken:

> For Class 1, 2, or 3 components, the inspection schedule of IWB-2400, IWC-2400, or IWD-2400, respectively, and the extent and frequency of IWB-2500-1, IWC-2500-1, or IWD-2500-1, respectively, provides for timely detection of degradation.

In its letter dated August 11, 2005, the applicant stated that its ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program includes implementation of Code Case N–526, Revision 13, "In-Service Inspection Code Case Acceptability, ASME Section XI, Division 1," issued January 2004, which provides alternative requirements for successive inspections mandated by IWB-2420 and IWC-2420 when areas of the vessel are found, by volumetric examinations, to contain subsurface flaws.

Table 1 of RG 1.147 lists Code Case N–526. The applicant categorized implementation of this code case as an exception to the GALL Report because the successive inspections required by IWB-2420 and IWC-2420 may be waived when a flaw is found acceptable for continued service in accordance with IWB-3600. In its letter dated August 11, 2005, the applicant stated that vessel aging effects are still managed and that any flaws for which successive inspections are waived are required to be acceptable for continued service in accordance with IWB-3600. The applicant also stated that the ASME Code, Section XI, requires that the sequence of component examinations established during the first inspection interval be repeated during each successive inspection interval to the extent practical. Because any flaws are determined to be acceptable in accordance with IWB-3600 and component examinations are required to be repeated during successive inspection intervals (so that any flaw area will be reexamined at least once in each inspection interval), the staff concluded that this exception to the GALL Report is acceptable.

Exception 5: The GALL Report identifies the following recommendation for the Detection of Aging Effects program element associated with the exception taken:

> **Class 1 Components, Table IWB-2500-1**
>
> Examination Category B-D, for full penetration welds of nozzles in reactor vessels, pressurizers, steam generators (primary side), and heat exchangers (primary side): This category specifies volumetric examination of all nozzle-to-vessel welds and the nozzle inside radius.

In its letter dated August 11, 2005, the applicant stated that its ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program will deviate from the requirements of ASME Code, Section XI, Table IWB–2500-1 and Figure IWB-2500-7(b) with regard to the examination volume for Category B-D components (full penetration welded nozzles in vessels).

The applicant identified that, based on its implementation of ASME Code, Section XI, Code Case N–613-1, "Ultrasonic Examination of Penetration Nozzles in Vessels, Examination Category B-D, Item Nos. B3.10 and B3.90, Reactor Nozzle to Vessel Welds, Figs. IWB–2500-7(a), (b), and (c), Section XI, Division 1," issued June 2001, examination of Category B-D components will deviate from the requirements of the 1995 edition through 1996 addenda of ASME Code, Section XI, Table IWB-2500-1, Item No B3.90 and from the requirements of ASME Code, Section XI, Figure IWB-2500-7(b). Specifically, Figure IWB-2500-7(b) requires that a minimum volume of material equal to a distance of one-half the reactor vessel shell thickness (i.e., a distance of approximately 2-1/2 inches for MNGP) be included in the examination volume on each side of the weld; however, the applicant's ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program at MNGP, instead, includes a reduced examination volume of one-half inch of base metal on each side of the widest portion of the weld. The applicant provided the following technical justification for the reduction in examination volume:

> The required examination volume for the reactor vessel pressure retaining nozzle-to-vessel welds extends far beyond the weld into the base metal, and is unnecessarily large. The proposed alternative re-defined the examination volume boundary to ½ inch of base metal on each side of the widest portion of the weld, removing from examination the base metal that was extensively examined during prior inspections, and that is not in the high residual stress region associated with the weld.
>
> The creation of flaws during plant service in the volume excluded from the proposed reduced examination is unlikely because of the low stress in the base metal away from the weld. The stresses caused by welding are concentrated at or near the weld. Cracks, should they initiate, occur in the high-stressed areas of the weld. These high-stress areas are contained in the volume that is defined by Code Case N–613-1 and are thus subject to examination. During previous examinations, no indications exceeding the allowable limits of the preservice or Inservice criteria were found in the reactor vessel nozzle to shell examination volumes including the base metal areas proposed for exclusion from examination in this request.

The staff reviewed the applicant's description and technical justification for this exception summarized in the preceding paragraph. The staff also reviewed the applicant's request for relief, "Request for Authorization to Utilize Code Case N–613-1," dated February 27, 2004, which provides a similar technical justification and includes tables of previous examination results. Because the examination volume will still include the heat-affected regions of base metal around the welds where new cracks are most likely to occur and previous examinations of the base metal beyond the heat-affected regions have detected no unacceptable conditions, the staff concluded that this exception is acceptable.

Exception 6: The GALL Report identifies the following recommendation for the Corrective Actions program element associated with the exception taken:

> For Class 1, 2, and 3, respectively, repair is in conformance with IWB-4000, IWC-4000, and IWD-4000, and replacement according to IWB-7000, IWC-7000, and IWD-7000. Approved BWRVIP-44 and BWRVIP-45 documents,

respectively, provide guidelines for weld repair of nickel alloys and for weldability of irradiated structural components.

In its letter dated August 11, 2005, the applicant stated that an approved alternative allows the use of the 2001 edition of the ASME Code, Section XI, in lieu of the 1995 edition with the 1996 addenda for repair/replacement activities. Section 3.0.3.1.7 of this SER provides the staff's evaluation of this exception.

On the basis that the NRC staff has already reviewed and approved this alternative related to repair and replacement generically for aging management of systems and components within the scope of license renewal, the staff concluded that it is not an exception and that the affected program element is consistent with the GALL Report.

Exception 7: The GALL Report identifies the following recommendation for the Detection of Aging Effects program element associated with the exception taken:

> Components are examined and tested as specified in Tables IWB-2500-1, IWC-2500-1, and IWD-2500-1, respectively, for Class 1, 2, and 3 components. The tables specify the extent and schedule of the inspection and examination methods for the components of the pressure-retaining boundaries. Alternative approved methods that meet the requirements of IWA-2240 are also specified in these tables.

In its letter dated August 11, 2005, the applicant stated that its ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program includes an RI-ISI methodology that provides an alternative to the ASME Code, Section XI, ISI requirements as to (1) the number of locations inspected, (2) the locations inspected, and (3) the method of inspection. This alternative applies to welds in ASME Code, Section XI, Categories B-F (Class 1 pressure retaining dissimilar metal welds in vessel nozzles), B-J (Class 1 pressure retaining welds in piping), C-F-1 (Class 2 pressure retaining welds in austenitic stainless steel or high-alloy piping), and C-F-2 (Class 2 pressure retaining welds in carbon or low-alloy steel piping).

The applicant submitted a description of its RI-ISI program in its letter dated December 18, 2001, "Alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and 2 Piping Welds—Risk Informed In-Service Inspection Program." In a letter, "Monticello Nuclear Generating Plant—Risk-Informed In-Service Inspection Program (TAC No. MB3818)," dated July 24, 2002, the NRC documents authorization for the applicant's RI-ISI program during the current (fourth) 10-year ISI interval.

In its letter dated August 11, 2005, supplemented by its August 31, 2005, letter, the applicant justified continuation of its RI-ISI program into the period of extended operation:

> ...The RI-ISI program maintains the fundamental requirements of ASME Section XI, such as the examination technique, examination frequency, and acceptance criteria. Although the RI-ISI program reduces the number of required examination locations, it maintains an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)3, by focusing inspections on the most safety significant welds with nondestructive examination techniques that are more

focused towards finding the type of expected degradation as well as the types of flaws and degradation found during traditional inspections.

A systematic approach was used to identify component susceptibility to common degradation mechanisms and to categorize these degradation mechanisms into the appropriate degradation categories with respect to their potential to result in a postulated leak or rupture in the pressure boundary. An evaluation to determine the susceptibility of components to a particular degradation mechanism that may be a precursor to a leak or rupture in the pressure boundary, and an independent assessment of the consequences of a failure at that location were performed. Industry and plant-specific piping operating experience was used to identify piping degradation mechanisms and failure modes, and consequence evaluations performed used probabilistic risk assessment to establish safety ranking of piping segments for selecting new inspection locations. The degradation mechanisms identified in the RI-ISI Program include thermal fatigue including thermal stratification, cycling, and striping (TASCS) and thermal transients (TT); intergranular stress corrosion cracking (IGSCC); and flow-accelerated corrosion (FAC). The consequences of pressure boundary failures were evaluated and ranked on their impact on core damage and early release. Therefore, redistributing the welds to be inspected with consideration of the safety significance of the segments provides assurance that segments whose failure have a significant impact on plant risk receive an acceptable and improved level of inspection.

The RI-ISI examinations result in improved detection of service-related degradations over those currently required by ASME Section XI. Therefore, the aging effect of cracking continues to be adequately managed for the piping welds.

The staff reviewed the applicant's technical justification for this exception. In addition, the staff reviewed the applicant's detailed RI-ISI program description in its letter requesting relief, dated December 18, 2001, and NRC authorization to implement the RI-ISI program in a letter dated July 24, 2002. Based on its review of these documents, the staff determined the following:

- The letter from MNGP dated December 18, 2001, lists 15 systems that its RI-ISI program encompasses.
- For 10 of the 15 systems that the RI-ISI methodology characterizes in the high- or medium-risk regions, the MNGP RI-ISI program will change the location and category and, typically, will reduce the number of inspected welds from the ASME Code, Section XI, numbers, locations, and categories. However, the applicant will continue to inspect a representative number of welds in each of these systems per ASME Code, Section XI, requirements.
- For 5 of the 15 systems (component cooling water, control rod drive (CRD) hydraulic, fuel pool emergency cooling, primary containment and atmospheric control, and torus hard vent systems) where the RI-ISI methodology characterizes all pipe welds in the low-risk region, the MNGP RI-ISI program will eliminate inspection of welds previously inspected in accordance with ASME Code, Section XI, requirements.

- The NRC staff review of the applicant's RI-ISI program, documented in a letter dated July 24, 2002, concluded that the MNGP RI-ISI program will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a with regard to the number of inspections, locations of inspections, and methods of inspections.

Supported by its previous approval of the applicant's RI-ISI program, the staff concluded that the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, as modified by the RI-ISI program approved by the NRC in a letter dated July 24, 2002, is acceptable for managing applicable component aging effects through the end of the applicant's current ISI inspection interval on May 31, 2012, approximately 21 months into the extended operating period. The staff based this conclusion on the fact that (1) the Class 1 and 2 welds affected by implementation of RI-ISI representative welds most susceptible to various age-related degradation mechanisms are still examined to ASME Code, Section XI, requirements, (2) any continuation of the RI-ISI program into the period of extended operation beyond May 31, 2012, will require review and authorization pursuant to 10 CFR 50.55a, and (3) any subsequent authorization to continue the RI-ISI program into the next ISI inspection interval will include consideration of any adverse industry or plant-specific operating experience that might preclude the use or require modification of the RI-ISI program for affected component aging management through the period of extended operation. On the basis of these considerations, the staff concluded that the applicant's implementation of RI-ISI is an acceptable exception to the Detection of Aging Effects program element as described in the GALL Report for AMP XI.M1.

Exception 8: The GALL Report recommends the following for the Detection of Aging Effects element associated with the exception taken:

> *Examination category B-H for integral attachments for vessels*: This category specifies volumetric or surface examination of essentially 100% of the length of the attachment weld at each attachment subject to examination.

In its letter dated August 11, 2005, the applicant stated that based on a relief request approved pursuant to 10 CFR 50.55a, its ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program excludes volumetric or surface examination of the reactor vessel stabilizer bracket welds to the exterior of the RPV. The 1995 edition of the ASME Code, Section XI, classifies the reactor vessel stabilizer bracket welds as Category B-H components (integral attachments for vessels) in the IWB-2500 examination category tabulation and, based on a change in ASME Code, Section XI, category nomenclature, the 1995 addenda classify them as Category B-K components (welded attachments for vessels, piping, pumps, and valves) in the IWB-2500 examination category tabulation.

In its letter dated August 11, 2005, the applicant justified not performing a volumetric or surface examination of the reactor vessel stabilizer bracket welds as specified by ASME Code, Section XI, and described in the GALL Report:

> Four RPV (reactor pressure vessel) stabilizer brackets are attached to the Class 1 RPV with full penetration fillet welds at 0°, 90°, 180°, and 270° RPV azimuth at an elevation of 994'-2". The RPV stabilizers are connected with flexible couplings to the brackets on the RPV and also to the biological shield wall. The RPV

stabilizers, brackets, and their attachment welds are designed to withstand and resist local loads (jet reaction forces) and seismic loads while allowing axial and radial movement due to normal thermal growth. The RPV stabilizer brackets do not provide structural support during normal operation. The MNGP RPV has never experienced jet reaction forces or seismic events, therefore the stabilizers, brackets, and attachment welds have not experienced the loads for which they are designed.

The area around the stabilizers is extremely congested. The vessel stabilizer brackets are surrounded by mirror insulation that is secured by cable hangers and buckles, ventilation ductwork with support bracing, and electrical installations such as thermocouples. All of this equipment must be relocated and restored to provide access to the stabilizers for examination of the welds. Additionally, due to the location of the stabilizer brackets and the lack of a working platform at the stabilizer location, a complex scaffold installation is required to provide access to the examination location.

As an alternative to the requirements of Table IWB-2500-1, Category B-K, Item B10.10, in Section XI of the ASME Code, the applicant proposed a surface examination on the stabilizer brackets if local (jet reaction forces) or seismic design loads are experienced. In addition, the applicant stated that a one-time VT-3 inspection of the accessible areas of all four welded attachments during the 2005 refueling outage noted no reportable conditions.

The applicant also stated that relief from this inspection will have no effect on aging management of the components within the scope of license renewal crediting these programs. The welds are part of the external surface of the reactor vessel. LRA Table 3.1.2-2 discusses aging management for the vessel external surface. The staff reviewed the applicant's justification for this exception. In addition, the staff reviewed the NRC's letter, "Monticello Nuclear Generating Plant—Fourth 10-Year In-Service Inspection Interval Request for Relief No. 4 (TAC No. MC2222)," dated January 6, 2005, in which the staff approved the applicant's request for relief from the requirements of the ASME Code, Section XI, with regard to the requirements of Table IWB-2500-1, Category B-K, Item B10.10 for inspection of the reactor vessel stabilizer bracket welds.

On the basis of the information reviewed and additional discussions with the applicant, the NRC issued RAI B2.1.2-1 on August 18, 2005, to obtain an additional technical basis for this exception. The staff asked the applicant to describe details of the weld used for the stabilizer bracket attachment, describe applicable examination requirements and any available results from the time of vessel manufacture, describe inspections since initial startup of the plant, identify and describe stressors that the welds experience during normal operation, state whether the welds have experienced any stressors different from the normal operating stressors, and summarize any related industry experience with similar welds known to the applicant.

In its response, dated September 16, 2005, the applicant provided additional information on weld type and examinations. The four 3-1/2-inch-thick stabilizer brackets are welded to the outside of the RPV with a double-bevel groove weld (3/16-inch root opening, 1/8-inch root face, and 30° groove angle) and a concave reinforcing fillet. At the time of vessel manufacture, a UT examination was conducted of the vessel shell surface before the stabilizer brackets were welded at the weld location to a depth at least equal to the thickness of the bracket and over the entire area of the subsequent connection, plus a band all around this area half as wide as the thickness of the bracket. After the stabilizer brackets were welded to the vessel, a magnetic particle examination was conducted of the welds. The only examination of the stabilizer bracket welds since manufacture occurred in March 2005 and consisted of a VT-3 examination of the stabilizer brackets using a flashlight and mirror looking for cracks or linear indications, wear, corrosion, and contaminants. This examination did not identify any reportable indications on any of the four stabilizer brackets.

The applicant's response also provided the following bases to conclude that degradation of the stabilizer bracket welds is unlikely:

- Degradation of the stabilizer bracket welds is unlikely because the cumulative fatigue usage factor for the stabilizer brackets is extremely low, so cracking due to fatigue is not expected to occur.
- The brackets and welds are made of carbon steel, and SCC is not applicable for this material; furthermore, during reactor operation, the drywell is maintained in an inert atmosphere with the RPV at high temperatures, so loss of material due to general corrosion is not expected to occur.
- MNGP does not use boric acid or a borated solution as a moderator in the reactor coolant system. Therefore, loss of material due to boric acid corrosion of external surfaces does not occur.
- Flexible couplings connect the RPV stabilizers to the brackets on the RPV and to the biological shield wall. The RPV stabilizers, brackets, and their attachment welds are designed to withstand and resist local loads (jet reactor forces) and seismic loads while allowing axial and radial movement due to normal thermal growth. During normal operation, there is no loading on the stabilizer brackets; the stabilizers, brackets, and attachment welds have never experienced the loads for which they were designed.
- Because of design differences, the Duane Arnold plant was able to conduct surface examinations on portions of its stabilizer bracket attachment welds in April 2005 and found no reportable indications. In addition, the MNGP staff does not know of any failures or defects of these or similar welds at any other boiling-water reactors (BWRs).

Based on the applicant's additional information that an appropriate original inspection of the stabilizer brackets and welds was performed, that there are no stressors to cause degradation of the brackets or welds during normal operation, that no operational events have subjected the brackets or welds to abnormal stressors, that a recent VT-3 examination of the brackets found no indications of weld or bracket degradation, and that industry operating experience does not suggest occurrence of any age-related degradation of the stabilizer brackets or welds, the staff concluded that this exception to the Detection of Aging Effects program element is acceptable.

The staff reviewed those portions of AMP B2.1.1, "ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program," that the applicant claimed are consistent with GALL AMP XI.M1 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions as described above.

Operating Experience. In LRA Section B2.1.2, the applicant stated that a review of operating experience for the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program identified no adverse trends or issues with program performance. The program identified and corrected problems before they caused any significant impact to safe operation or loss of intended functions. The applicant took corrective actions to prevent recurrence. The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program monitors the condition of the pressure-retaining components within the license renewal boundary. MNGP procedures contain guidance for indications of degradation requiring evaluation, repair, or replacement. The applicant performs periodic self-assessments and reviews of industry and plant experience to identify any areas needing improvement. Some examples include the following:

- The applicant modified its ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program at the end of the third interval to incorporate an improved strategy for NDE as described in EPRI TR-112657 and in compliance with the requirements of RG 1.174, Revision 1, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," issued November 2002, and RG 1.178, Revision 1, "An Approach for Plant-Specific Risk-Informed Decision-Making for In-Service Inspection of Piping," issued September 2003.
- Inspections in 1998 and 2001 of steam dryer jacking screws revealed a crack-like indication in the screw tack weld at 325 degrees. Following the inspection in 1998, an evaluation indicated that the crack was acceptable. Reinspections of the jacking screws in 2001 showed no crack growth in the 325 degree screw and no indications of cracking in the other screws.
- The applicant detected cracking in 34 tack welds on jet pump beam adjusting screws in 1994 during the in-vessel visual inspection at the end of cycle 16. Cracking was ascribed to high cycle fatigue. Applicant staff restored tack welds so that each adjusting screw had a minimum of one uncracked tack weld. Tack welds are and will continue to be visually inspected.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its evaluation of the applicant's program against the program elements described in the GALL Report AMP, its review of the above industry and plant-specific operating experience, and its discussions with the applicant's technical personnel, the staff concluded that the applicant's ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.2, the applicant provided the USAR supplement for the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 ASME Section XI, Subsection IWF Program

Summary of Technical Information in the Application. In LRA Section B2.1.3, the applicant described the ASME Section XI, Subsection IWF Program, stating that this existing program is consistent, with enhancement, with GALL AMP XI.S3, "ASME Section XI, Subsection IWF." The MNGP ASME Section XI, Subsection IWF Program is part of the MNGP ASME Section XI In-Service Inspection Program. The applicant performs the ASME Section XI, Subsection IWF Program in accordance with the ASME Code, Section XI, 1995 edition through the 1996 addenda and 10 CFR 50.55a. The program provides for condition monitoring of Class 1, 2, 3, and MC component supports. The applicant selects component supports for inspection in accordance with the ASME Code classification and increases the quantity of component supports selected for examination as a result of discovered support deficiencies. Visual inspection is the primary method for identifying deficiencies. The applicant periodically updates the program as required by 10 CFR 50.55a.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the enhancement and the associated justifications to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.S3.

In the LRA, the applicant stated that, after enhancement of its current program, it will contain no exceptions to program elements of GALL AMP XI.S3; however, during the audit and review, the staff asked the applicant whether its approved ISI relief requests or code cases affect any of its AMP elements. In its letter dated August 11, 2005, supplemented by its letter dated August 31, 2005, the applicant identified for Code Case N–491-2, "Rules for Examination of Class 1, 2, 3, and MC Component Supports of Light-Water Cooled Power Plants, Section XI, Division 1," issued March 2000, the following exception to the GALL Report program element.

Exception: The GALL Report recommends the following for the Corrective Actions program element associated with the exception taken:

> In accordance with IWF-3122, supports containing unacceptable conditions are evaluated or tested, or corrected before returning to service. Corrective actions

are delineated in IWF-3122.2. IWF-3122.3 provides an alternative for evaluation or testing to substantiate structural integrity and/or functionality.

In its letter dated August 11, 2005, the applicant stated that it may perform corrective measures on a component support to return it to design condition after acceptance by evaluation or test without requiring additional examinations.

The applicant explained that most of the provisions of the original code case were added to the 1990 addenda to the ASME Code, Section XI, but that Code Case N–491-2 provisions were added to IWF-3112.3 and IWF-3122.3 in the 1997 addenda. Because some of the provisions were added by ASME Code, Section XI, addenda later than what the GALL Report references, the applicant has identified these provisions as an exception to the GALL Report description of the ASME Section XI, Subsection IWF Program.

The applicant stated in its letter dated August 11, 2005, that this exception to the Corrective Action Program element of GALL Report AMP XI.S3 will have no impact on aging management for the component supports. The staff reviewed the applicant's description of this exception together with requirements specified in the ASME Code, Section XI, 1995 Edition through 1996 Addenda. Because the applicant's AMP provides inspections required by ASME Code, Section XI, Subsection IWF (involving requirements for Class 1, 2, 3, and MC component supports of light-water-cooled power plants) and requires reasonable and appropriate corrective actions before a defective component returns to service, the staff agreed that this exception will have no detrimental impact on the adequacy of affected component aging management. For this reason, together with review of the ASME Section XI, Subsection IWF Program operating experience, the staff found this exception acceptable.

In the LRA, the applicant stated that it will implement the following enhancement to make this AMP consistent with the recommendation in the GALL Report.

Enhancement: The GALL Report recommends the following for the Scope of Program program element associated with the enhancement made:

> Starting with the 1990 Addenda to the 1989 Edition, the scope of Subsection IWF was revised. The required percentages of each type of nonexempt support subject to examination were incorporated into Table IWF-2500-1. The revised percentages are 25% of Class 1 nonexempt piping supports, 15% of Class 2 nonexempt piping supports, 10% of Class 3 nonexempt piping supports, and 100% of supports other than piping supports (Class 1, 2, 3, and MC). For pipe supports, the total sample consists of supports from each system (such as main steam, feedwater, residual heat removal), where the individual sample sizes are proportional to the total number of nonexempt supports of each type and function within each system. For multiple components other than piping within a system of similar design, function, and service, the supports of only one of the multiple components are required to be examined. To the extent practical, the same supports selected for examination during the first inspection interval are examined during each successive inspection interval.

In the LRA, the applicant stated that it will enhance its ASME Section XI, Subsection IWF Program to inspect Class MC components supports consistent with the GALL Report, Chapter III, Section B1.3, "Supports for ASME Class MC Components."

During the audit and review, the staff asked the applicant for more details about its current IWF program and to identify the inspections that the enhancement will add. In response, the applicant provided the following information:

- The current MNGP IWF program does not include VT-3 examination of MC supports.
- The current MNGP IWE program includes general visual examinations of MC components and their supports in accordance with ASME Code, Section XI, Table IWE-2500-1.

The applicant stated that examinations conducted under the current IWE program include the following MC supports:

- torus/ring header seismic restraints
- drywell male and female stabilizers
- shield stabilizers
- torus columns
- torus saddles
- vent system supports
- downcomer bracing

The applicant further stated that for the period of extended operation, the ASME Section XI, Subsection IWF Program will perform VT-3 examinations of the MC supports listed above in accordance with ASME Code, Section XI, Table IWF-2500-1 in compliance with the ASME Code, Section XI, 1995 edition and 1996 addenda ISI requirements. In addition, for the period of extended operation, the ASME Section XI, Subsection IWE Program will continue the general visual examination of the MC components and their supports listed above in accordance with ASME Code, Section XI, Table IWE-2500-1.

The staff reviewed the applicant's response together with the applicant's program-basis document (PBD) for the IWF program. The staff concluded that by adding a requirement for VT-3 inspection of MC component supports, the applicant's current program will be consistent with GALL AMP XI.S3. On this basis, the staff found the applicant's response acceptable.

The staff asked whether the applicant's program, when enhanced as described in the LRA, will provide for inspection of all Class MC supports rolled up into applicable line items of the GALL Report, Chapter II, Section B1.3, which specifies ASME Code, Section XI, Subsection IWF as the AMP. In response, the applicant stated the following:

> When the ASME Section XI, Subsection IWF Program is enhanced, all MNGP MC supports will be rolled up into the applicable NUREG-1801 line items to the extent required by ASME Section XI, Table IWF-2500-1.

The staff reviewed the applicant's response together with the applicant's proposed program enhancement as described in the LRA and evaluated in the applicant's PBDs. Based on this review, the staff concluded that the applicant's program includes appropriate components as required by ASME Code, Section XI, Table IWF-2500-1. On this basis, the staff found the applicant's response acceptable.

Based on the applicant's responses to the staff's questions and review of associated documents provided by the applicant, the staff concluded that the existing program, enhanced as described in the LRA, will be fully consistent with the AMP elements described in GALL AMP XI.S3.

The applicant stated, in the LRA, that the enhancement is required to satisfy the GALL Report AMP recommendations and is scheduled for implementation before the period of extended operation. On the basis of its evaluations of the applicant's program against the program elements described in the GALL Report AMP, together with its review of AMP B2.1.3, "ASME Section XI, Subsection IWF," program operating experience, the staff found this enhancement acceptable, as such changes to the applicant's program provide assurance that the program will adequately manage the effects of aging.

The staff reviewed those portions of AMP B2.1.3 that the applicant claimed are consistent with GALL AMP XI.S3 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exception and enhancement as described above.

Operating Experience. In LRA Section B2.1.3, the applicant stated that the MNGP ASME Section XI, Subsection IWF Program addresses industry operating experience and prescribes the need for additional augmented requirements for Class 1, 2, 3, and MC component supports as applicable. In addition, MNGP has been performing a general visual examination on accessible Class MC component supports in accordance with the ASME Section XI, Subsection IWE Program and has not identified any aging effects of concern.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its evaluation of the applicant's program against the program elements described in the GALL Report AMP, its review of the above industry and plant-specific operating experience, and discussions with the applicant's technical personnel, the staff concluded that the applicant's ASME Section XI, Subsection IWF program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.3, the applicant provided the USAR supplement for the ASME Section XI, Subsection IWF Program.

Subsequently, by letter dated June 10, 2005, the applicant revised its USAR supplement to include the following commitment, documented as commitment 9 in Table A.5:

> Prior to the period of extended operation, the MNGP ASME Section XI, Subsection IWF Program will be enhanced to provide inspections of Class MC components supports consistent with NUREG-1801, Chapter III Section B1.3.

The staff reviewed this section and determined that the information in the USAR supplement as augmented by the commitment adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's ASME Section XI, Subsection IWF Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancement and confirmed that its implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Bolting Integrity Program

Summary of Technical Information in the Application. In LRA Section B2.1.4, the applicant described its Bolting Integrity Program, stating that this existing AMP is consistent, with enhancements, with GALL AMP XI.M18, "Bolting Integrity."

The applicant stated that the Bolting Integrity Program manages the aging affects associated with bolting within the scope of license renewal through periodic inspection, material selection, thread lubricant control, assembly and torque requirements, and repair and replacement requirements. These activities are based on the applicable requirements of the ASME Code, Section XI, and plant operating experience and include consideration of the guidance contained in NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," EPRI TR-104213, "Bolted Joint Maintenance & Application Guide," and EPRI NP-5067, Volumes 1 and 2, "Good Bolting Practices."

The Bolting Integrity Program credits 11 AMPs for the inspection of installed bolts, namely (1) 10 CFR 50, Appendix J, (2) ASME Section XI In-Service Inspection, Subsections IWB, IWC and IWD, (3) Primary Containment In-Service Inspection, (4) Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems, (5) ASME Section XI, Subsection IWF, (6) Buried Piping and Tanks Inspection, (7) Bus Duct Inspection, (8) BWR Vessel Internals, (9) Reactor Head Closure Studs Monitoring, (10) System Condition Monitoring, and (11) Structures Monitoring Programs.

The applicant stated that enhancements are required to satisfy the GALL Report AMP recommendations. It will add the enhancements to the Parameters Monitored or Inspected and Acceptance Criteria elements of the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, Structures Monitoring Program, and System Condition Monitoring Program. These enhancements will add guidance for visual bolting inspections found in EPRI TR-104213 and EPRI NP- 5067, Volumes 1 and 2.

The LRA also states that inspection of bolting for ASME Code, Section XI, Class 1, 2, 3, and MC components is in accordance with the ASME Code, Section XI requirements. Because the scope of license renewal includes components besides those related to ASME Code, Section XI, the applicant relies upon other programs for additional inspections that include checking the material condition of bolting for signs of corrosion, wear, and other problems, and associated pressure-retaining joints for signs of leakage. Upon detection of degraded conditions, the applicant performs followup inspections, repairs, replacements, or application of additional testing methods as required by the site CAP and applicable ASME Code, Section XI acceptance criteria.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff reviewed the Bolting Integrity Program against the AMP elements in the GALL Report, SRP-LR Section A.1.2.3, and SRP-LR Table A.1-1 and focused on the program's management of aging effects through the incorporation of the 10 program elements. The applicant indicated that the site-controlled Quality Assurance Program includes the Corrective Actions, Confirmation Process, and Administrative Controls elements. SER Section 3.0.4 discusses the staff's evaluation of the Quality Assurance Program.

LRA Section B2.1.4 states that the Bolting Integrity Program is consistent with GALL AMP XI.M18 with enhancements added to the Parameters Monitored or Inspected and Acceptance Criteria elements of the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, Structures Monitoring Program, and System Condition Monitoring Program. These enhancements will add guidance for visual bolting inspections found in EPRI TR-104213, and EPRI NP-5067, Volumes 1 and 2. The staff reviewed the Parameters Monitored or Inspected and Acceptance Criteria elements and concluded that the applicant has acceptable criteria for visual bolting inspections and acceptance criteria for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, Structures Monitoring Program, and System Condition Monitoring Program. The staff has reviewed and approved similar enhancements to bolting programs based on EPRI NP-5067 and EPRI TR-104213, as documented in NUREG-1743, "Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 1," issued April 2001. For these reasons, the staff found that the guidelines for enhancements to the Bolting Integrity Program reflect industry practice and meet the recommendations of GALL AMP XI.M18.

The staff's review of LRA Section B2.1.4 identified an area for which it needed additional information to complete its evaluation of the applicant's program elements. The applicant responded to the staff's RAI as discussed below.

In RAI B2.1.4-1, dated July 20, 2005, the staff noted that Table Items 3.3.1-18, 3.3.1-24, and 3.4.1-08 in the LRA provide a general discussion of the Bolting Integrity Program as applied to the ESF, auxiliary, and steam and power conversion (SPC) systems. Therefore, the staff requested that the applicant state whether the Bolting Integrity Program manages all closure bolting in the ESF, auxiliary, and SPC systems for loss of preload, even though the AMR tables contain no specific line items for this aging effect.

In its response, by letter dated August 16, 2005, the applicant stated the following:

> As discussed in Section B2.1.4 of the License Renewal Application, the Bolting Integrity Program manages aging effects for bolting within the scope of license renewal. This includes closure bolting that is required to support a pressure boundary intended function for components of the systems listed in Section B2.1.4, Scope of Program. Detection of aging effects includes visual inspection of pressure retaining joints for signs of leakage, which may be the result of loss of preload. With the exception of the Emergency Filtration (EFT) System, this includes all closure bolting of the Engineered Safety Features (ESF), Auxiliary, and Steam and Power Conversion (SPC) systems in the LRA. As noted in LRA Table 3.3.2-7, bolting of the EFT System is not susceptible to aging effects due to is location in a controlled environment and is, therefore, not included in the Bolting Integrity Program.

In a telephone conversation on November 4, 2005, the staff requested that the applicant explain why closure bolting of the EFT system is not susceptible to aging effects and not included in the Bolting Integrity Program.

In its response, by letter dated November 17, 2005, the applicant stated that bolting in the EFT system is not susceptible to aging effects (i.e., corrosion) because of its location in a controlled air environment; however, the Bolting Integrity Program is credited with managing the loss of preload aging effect for the EFT system. The applicant supplemented its response to RAI B2.1.4-1 as follows:

> Closure bolting of the EFT system is managed by the Bolting Integrity Program for loss of preload. Section B.2.1.4, Scope of Program, of the LRA for the Bolting Integrity Program is revised to include the EFT system.

Based on its review, the staff found the applicant's response to RAI B2.1.4-1 acceptable. The applicant stated that the Bolting Integrity Program manages all closure bolting in the ESF, auxiliary, and SPC systems for loss of preload; therefore, the staff's concern described in RAI B2.1.4-1 is resolved.

During the audit and review, the staff asked the applicant whether its current approved ISI relief requests or code cases affect any of its AMP program elements. In its letter dated August 31, 2005, the applicant identified the following exception to the GALL Report for the Bolting Integrity Program:

> Element: 7: Corrective Actions
> Exception: An approved alternative allows the use of the 2001 Edition of ASME Section XI in lieu of the 1995 Edition with the 1996 Addenda for repair/replacement activities.

SER Section 3.0.3.1.7 documents the staff's evaluation of this exception.

Because the NRC has already reviewed and approved this alternative, as it relates to repair and replacement, generically for aging management of systems and components within the scope of license renewal, the staff concluded that the applicant need not classify it as an exception and that, with regard to this item, the affected program element is consistent with the GALL Report.

Operating Experience. The applicant stated that both the industry and the NRC have revealed a number of instances of bolting concerns, from material control and certification to bolting practices, use of lubrication, and the impact of aging mechanisms. The MNGP Bolting Integrity Program incorporates both plant and industry experience on bolting issues. For example, MNGP previously evaluated and addressed NRC information notices (INs), bulletins, circulars, and GLs listed in Section 3 of NUREG-1339. Some of these resulted in confirmatory analyses or inspections and others in modifications or the addition of special items to consider in the procurement and design processes. MNGP replaced all reactor vessel shroud head bolts with a new vendor recommended design, for example, when it identified cracking issues with the prior design.

A review of plant operating experience identified issues with missing or loose bolts, inadequate thread engagement, and improper bolt applications. In all cases, MNGP corrected the identified concern; no significant safety event resulted; and the applicant implemented additional actions, such as procedural enhancements, as needed to minimize the potential for recurrence.

In RAI B2.1.4-2, dated July 20, 2005, the staff noted that, after the applicant had submitted the LRA, failed bolts on tee-quencher supports were found at the Hatch Nuclear Plant Unit 2 (Hatch 2). Subsequent analysis revealed that high-strength bolts are susceptible to hydrogen-induced cracking and may fail after 20 to 25 years of service. Therefore, the staff requested that the applicant explain why the tee-quencher bolts at MNGP will not fail as a result of hydrogen-induced cracking.

In its response, by letter dated August 16, 2005, the applicant stated that the tee-quencher support design at MNGP differs from the design at Hatch 2. In addition, all bolts are 1-inch-diameter, 3.75-inch-long hex bolts procured to the requirements of American Society for Testing Materials (ASTM) A-325 Type 1 or A-193 Grade B7 material specification. These are not high-strength bolts, having ultimate strength of approximately 125 ksi or less, and are well below the ultimate strength of SA540 Grade B21 Class 1 bolts at Hatch 2. Further, analysis of the Hatch 2 event determined that the most likely cause of SCC of the high-strength bolts was the significant contribution of hydrogen embrittlement. One possible source of the hydrogen embrittlement was the use of a zinc primer inside the torus. MNGP does not use a zinc primer; instead, it uses a modified phenolic-based primer in the torus. Finally, MNGP performs underwater inspections of these bolts periodically, and the May 1993 inspection identified no problems or loose connections.

Based on its review, the staff found the applicant's response to RAI B2.1.4-2 acceptable. The staff concurred with the applicant's conclusions that the Hatch 2 event does not apply to MNGP because the tee-quencher design differs from the design at Hatch 2. The bolts at MNGP are lower strength bolts not susceptible to SCC, and the application of phenolic-based instead of zinc-based primer inside the torus has minimized any source of hydrogen. In addition, the applicant performs periodic inspection of tee-quencher bolts in accordance with the requirements of its Primary Containment In-Service Inspection Program, providing added assurance that bolting materials inside the torus will be adequately managed during the period of extended operation. Therefore, the staff's concern described in RAI B2.1.4-2 is resolved.

On the basis of its review of the above industry and plant-specific operating experience, the staff concluded that the Bolting Integrity Program will adequately manage the aging effects identified in the LRA for which this AMP is credited. The staff concluded that this program attribute is acceptable.

USAR Supplement. In LRA Section A2.1.4, the applicant provided the USAR supplement for the Bolting Integrity Program.

Subsequently, by letter dated June 10, 2005, the applicant revised its USAR supplement to include the following commitment, documented as commitment 10 in Table A.5:

> Prior to the period of extended operation, the guidance for performing visual bolting inspections contained in EPRI TR-104213, Bolted Joint Maintenance & Application Guide, and the Good Bolting Practices Handbook (EPRI NP-5067 Volumes 1 and 2) will be included in the Bus Duct Inspection Program, Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, Structures Monitoring Program and the System Condition Monitoring Program.

The staff reviewed this section and determined that the information in the USAR supplement as augmented by the commitment adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Bolting Integrity Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Buried Piping & Tanks Inspection Program

Summary of Technical Information in the Application. In LRA Section B2.1.5, the applicant described the Buried Piping & Tanks Inspection Program, stating that this existing program is consistent, with enhancements, with GALL AMP XI.M34, "Buried Piping and Tanks Inspection." The Buried Piping & Tanks Inspection Program consists of preventive and condition monitoring measures to manage the aging effects for buried piping, conduit, and tanks within the scope of license renewal. Buried components within the scope of license renewal include carbon steel piping, bolting, conduit, and tanks (loss of material due to general, crevice, galvanic, pitting, and microbiologically influenced corrosion (MIC)) and cast iron piping (loss of material due to general, crevice, galvanic, and pitting corrosion, MIC, and selective leaching). Preventive measures consist of protective coatings and/or wraps on buried components. Condition monitoring consists of periodic inspections of buried components. In addition, buried components are not routinely uncovered during maintenance activities. Therefore, other system monitoring and functional testing activities are relied upon to provide effective degradation aging management of buried piping and tanks. Some of these activities are neither preventive nor mitigative in nature, but they do provide indication of a leak. However, the potential problem (i.e., small leak) is detected at an early stage, such that repairs can be made before the loss of component intended function.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses consistency of the AMP elements with GALL AMP XI.M34.

In the LRA, the applicant stated that the following enhancements will make this AMP consistent with the recommendation in the GALL Report.

Enhancement 1: The GALL Report recommends the following for the Scope of Program program element associated with the enhancement made:

> The program relies on preventive measures such as coating and wrapping and periodic inspection for loss of material caused by corrosion of the external surface of buried carbon steel piping and tanks. Loss of material in these components, which may be exposed to aggressive soil environment, is caused by general, pitting, and crevice corrosion, and microbiologically influenced corrosion (MIC). Periodic inspections are performed when the components are excavated for maintenance or for any other reason.

The applicant stated in the LRA that it will update the scope of the Buried Piping & Tanks Inspection Program to implement procedures to include inspections of buried components when uncovered. In interviews with the applicant's technical personnel about the enhanced program, the applicant stated that the enhanced program will take inspection opportunities when buried components are uncovered at times other than scheduled buried piping inspections. In addition, it will update the excavating procedure to perform inspection(s), when buried components are uncovered. The staff reviewed the applicant's response and plant procedures and found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

During the aging management inspection, the inspectors noted that, although the PBDs indicate that the Buried Piping & Tanks Inspection Program would manage buried conduit, the existing inspections and related procedures were limited to buried piping and the diesel fuel oil storage tank. Since buried conduit is galvanized and not wrapped or coated, aging of conduit could be different from that of underground piping and tanks. In its letter dated March 15, 2006, the applicant amended the scope of the program to include conduit. The staff found this acceptable because it ensures that potential aging effects of buried conduit are managed.

Enhancement 2: The GALL Report recommends the following for the Parameters Monitored or Inspected program element associated with the enhancement made:

> The program monitors parameters such as coating and wrapping integrity that are directly related to corrosion damage of the external surface of buried carbon steel piping and tanks. Coatings and wrappings are inspected by visual techniques. Any evidence of damaged wrapping or coating defects, such as coating perforation, holidays, or other damage, is an indicator of possible corrosion damage to the external surface of piping and tanks.

In the LRA, the applicant stated that it will add the Diesel Fuel Oil Storage Tank T-44 internal inspections to the list of scheduled inspections in the Buried Piping & Tanks Inspection Program.

The staff noted that the applicant's buried diesel fuel oil storage tank inspection is an internal inspection. In RAI B2.1.5-1, dated October 31, 2005, the staff requested that the applicant clarify whether the diesel fuel oil storage tank internal inspection is in addition to or in lieu of the external inspection recommended in the GALL Report.

In its response, by letter dated November 22, 2005, the applicant stated that the Buried Piping & Tanks Inspection Program and the 10-year diesel fuel oil storage tank internal inspection will supplement the external inspection as recommended in the GALL Report and will include both visual and UT inspections. External inspections of the diesel fuel oil storage tank will take place as opportunities arise. Should the applicant excavate the tank during maintenance activities, it will perform an external inspection consistent with the GALL Report for inspecting the external surfaces of buried piping and tanks.

In the Detection of Aging Effects program element, the applicant stated, "An enhancement to the underground piping inspections is to include a provision that if evaluations of pipe wall thickness show a susceptibility to corrosion, further evaluation as to the extent of susceptibility will be performed." The applicant restated in its RAI response that inspections of the external surfaces of other buried carbon steel components will also indicate the external surface condition of the diesel fuel oil storage tank.

The applicant stated that the diesel fuel oil storage tank internal inspection supplements the external inspections recommended in the GALL Report and, therefore, is an acceptable AMP for the detection of aging effects consistent with the GALL Report. The staff reviewed the applicant's response and found this enhancement acceptable as it provides assurance that the effects of aging will be adequately managed.

Enhancement 3: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the enhancement made:

> Periodic inspection of susceptible locations to confirm that coating and wrapping are intact is an effective method to ensure that corrosion of external surfaces has not occurred and the intended function is maintained. The inspections are performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems. Because the inspection frequency is plant-specific and also depends on the plant operating experience, the applicant's proposed inspection frequency is to be further evaluated for the extended period of operation.

In the LRA, the applicant stated that it will revise the Buried Piping & Tanks Inspection Program to include a provision that if evaluations of pipe wall thickness show susceptibility to corrosion, further evaluation as to the extent of susceptibility will be performed. It will revise the Buried Piping & Tanks Inspection Program to specify a 10-year buried pipe inspection frequency and a 10-year Diesel Fuel Oil Storage Tank T-44 internal inspection frequency.

During the audit and review, the staff asked the applicant about the types of inspections it will perform for this program before the period of extended operation. In response, the applicant stated that a visual and UT inspection of the buried Diesel Fuel Oil Storage Tank T-44 was performed in 2003 and showed no significant loss of material due to corrosion on the tank interior. Additionally, the applicant stated that a visual and UT inspection of the buried pipe near the offgas stack was performed in 1999 and no degradation due to aging effects was detected. The applicant also stated that it regularly inspects the underground piping for the offgas system going to the plant stack. The Offsite Safety Review Committee established this requirement to preclude leakage of offgas from the underground piping for any reason, including aging effects.

The staff reviewed the applicant's response and plant procedures and found the enhancement acceptable by providing assurance that AMP B2.1.5, "Buried Piping & Tanks Inspection Program," is consistent with the AMP elements described in GALL AMP XI.M34.

Enhancement 4: The GALL Report recommends the following for the Monitoring and Trending program element associated with the enhancement made:

> Results of previous inspections are used to identify susceptible locations.

In the LRA, the applicant stated that the underground piping inspections will include review of previous buried piping issues to determine possibly susceptible locations.

During the audit and review, the applicant provided technical information regarding the statement that MNGP has mild soil conditions. In response to the staff's questions, the applicant provided technical data for pH, chloride, and sulfate concentrations, which verified this conclusion. The enhancement of the Monitoring and Trending program element will include a review of previous buried piping issues to determine possibly susceptible locations. The staff reviewed the applicant's response and found AMP B2.1.5 consistent with the AMP elements described in GALL AMP XI.M34.

The staff reviewed those portions of AMP B2.1.5 that the applicant claimed are consistent with GALL AMP XI.M34 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the enhancements as described above.

Operating Experience. In LRA Section B2.1.5, the applicant stated that the Buried Piping & Tanks Inspection Program relies on preventive measures, periodic inspections, and functional testing to manage the aging effects of buried components. MNGP operating experience has shown no buried component failures for systems within the scope of license renewal (emergency service water (ESW), diesel generator, hangars and supports, secondary containment system, fire system (FIR)). The only failures of buried components were on the well water piping system and the instrument air system to the cooling towers. These are not SR systems and they are outside the scope of license renewal. The failures are not located near any buried components within the scope of license renewal. The well water piping failure was postulated to be caused by MIC and not a failure of the protective coating. The cause of the failure of the instrument air line is yet to be determined. Periodic visual and UT inspections of buried pipe have shown no significant loss of material due to pipe corrosion. Periodic UT inspections of the diesel fuel oil storage tank interior have also shown no significant loss of material due to corrosion. Periodic functional testing of the ESW and fire header systems has shown no functional failures. Periodic vapor point monitoring and ground water monitoring near the diesel fuel oil storage tank have shown no functional failures of the storage tank or the diesel fuel oil lines.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review, operating experience documentation, and discussions with the applicant's technical personnel, the staff concluded that the applicant's Buried Piping & Tanks Inspection Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

<u>USAR Supplement</u>. In LRA Section A2.1.5, the applicant provided the USAR supplement for the Buried Piping & Tanks Inspection Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant supplemented LRA Section A2.1.5 by listing the following commitments, documented as commitments 11–16 in Table A.5, to be performed before the period of extended operation:

(1) The Buried Piping and Tanks Inspection Program will update the implementing procedures to include inspections of buried components when they are uncovered.

(2) The Diesel Fuel Oil Storage Tank, T-44, internal inspection will be added to the list of scheduled inspections in the Buried Piping and Tanks Inspection Program.

(3) The Buried Piping and Tanks Inspection Program will be revised to include a provision that if evaluations of pipe wall thickness show a susceptibility to corrosion, further evaluation as to the extent of susceptibility will be performed.

(4) The Buried Piping and Tanks Inspection Program will be revised to specify a 10-year buried pipe inspection frequency.

(5) The Buried Piping and Tanks Inspection Program will be revised to specify a 10-year inspection frequency for Diesel Fuel Oil Storage Tank T-44.

(6) The Buried Piping and Tanks Inspection Program will be revised to include a review of previous buried piping issues to determine possible susceptible locations.

Conclusion. On the basis of its review and audit of the applicant's Buried Piping & Tanks Inspection Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 BWR Control Rod Drive Return Line Nozzle Program

Summary of Technical Information in the Application. In LRA Section B2.1.7, the applicant described the BWR CRD Return Line Nozzle Program, stating that this existing program is consistent, with exceptions, with GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle." The MNGP BWR CRD Return Line Nozzle Program is part of the MNGP ASME Section XI In-Service Inspection Program. The BWR CRD Return Line Nozzle Program is in accordance with the ASME Code, Section XI, 1995 edition through the 1996 addenda, and provides for condition monitoring of the BWR CRD return line (CRDRL) nozzle. In 1977, the CRDRL nozzle safe end was removed and the CRDRL nozzle was capped. In 1986, the CRDRL nozzle was modified again by removing the portion of the existing weld butter layer susceptible to IGSCC, by re-cladding the weld prep area with corrosion-resistant cladding, and by installing a new nozzle cap of non-IGSCC susceptible stainless steel. As a result of capping the CRDRL nozzle, the NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10," issued November 1980, augmented examinations are no longer required. Not performing the NUREG-0619 augmented examinations is considered an exception to GALL Report AMP XI.M6. The applicant updates the program periodically as required by 10 CFR 50.55a.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M6.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M6 in the GALL Report.

Exception 1: The GALL Report recommends the following for the Parameters Monitored or Inspected, Detection of Aging Effects, and Monitoring and Trending program elements associated with the exception taken:

The aging management program (AMP) monitors the effects of cracking on the intended function of the component by detecting and sizing cracks by ISI in accordance with Table IWB 2500-1 and NUREG-0619.

The extent and schedule of inspection, as delineated in NUREG 0619, assures detection of cracks before the loss of intended function of the component. Inspection recommendations include liquid penetrant testing (PT) of the CRDRL nozzle blend radius and bore regions and the reactor vessel wall area beneath the nozzle, return-flow-capacity demonstration, CRD-system-performance testing and ultrasonic inspection of welded connections in the rerouted line. The inspection is to include base metal to a distance of one-pipe-wall thickness or 0.5 in., whichever is greater, on both sides of the weld.

The inspection schedule of NUREG-0619 provides timely detection of cracks.

In the LRA, the applicant stated that it does not perform the NUREG-0619 augmented inspections; it removed the CRDRL nozzle safe end and capped the nozzle in 1977. The applicant also stated that it modified the nozzle again in 1986 to remove that portion of the existing weld butter layer susceptible to IGSCC by re-cladding the weld prep area with corrosion-resistant cladding and by installing a new nozzle cap of 316 L nuclear-grade stainless steel. Because of these modifications, the applicant stated in its LRA that the required augmented inspections on the CRDRL nozzle specified in NUREG-0619 through NRC GL 80-95, "Generic Activity A-10," dated November 13, 1980, are no longer necessary. Although the applicant did not perform those augmented inspections specified in NUREG-0619, it did follow the guidance in NUREG-0619, Section 8.2, for other inspections and maintenance activities related to the CRD system. The following summarizes the activities related to NUREG-0619, Section 8.2:

- Section 8.2(3)—The final PT inspection of the CRDRL nozzle showed no indications. A system flow and performance test had satisfactory results.
- Section 8.2(3a)—The welded connection joining the rerouted CRDRL to the reactor water cleanup (RWCU) system is inspected every refueling outage with UT and includes base metal to a distance of one pipe-wall thickness or 0.5 inches, whichever is greater, on both sides of the weld.
- Section 8.2(3b)—The remainder of the CRDRL does not meet the definition of Class 1, 2, or 3 pipe and, therefore, NUREG-0313, Revision 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," issued January 1988, does not require augmented inspections.
- Section 8.2(3c)—Since carbon steel piping was retained in the exhaust header, procedures were developed for (1) periodically performing a random sampling of hydraulic accumulator unit filters to determine if cleaning and flushing is required, and (2) periodically performing a flush of the CRD exhaust header.

The applicant further stated that its commitment in response to GL 80-95 to implement the requirements for the CRDRL nozzle specified in NUREG-0619, Section 8, has been completed. The activities described above relating to NUREG-0619, Sections 8.2(3a) and 8.2(3c), are existing NRC commitments and will continue through the period of extended operation.

On the basis of its review of the completion of CRDRL nozzle-related modifications, the completion of commitments in response to GL 80-95, and operating experience for AMP B2.1.7, the staff found this exception acceptable.

During the audit and review, the staff asked the applicant whether its current approved ISI relief requests or code cases affect any of its AMP program elements. In its letter dated August 31, 2005, the applicant identified the following additional exception to the GALL Report program element:

Exception 2: The GALL Report recommends the following for the Corrective Actions program element associated with the exception taken:

> Repair is in conformance with IWB-4000 and replacement in accordance with IWB-7000.

In its letter dated August 11, 2005, the applicant stated that an approved alternative allows the use of the ASME Code, Section XI, 2001 edition in lieu of the 1995 edition with the 1996 addenda for repair/replacement activities.

The staff concluded that this item is not an exception and that with regard to this item, the affected program element is consistent with the GALL Report. SER Section 3.0.3.1.7 documents the staff's evaluation.

The staff reviewed those portions of AMP B2.1.7, "BWR Control Rod Drive Return Line Nozzle Program," that the applicant claimed are consistent with GALL AMP XI.M6 and found them consistent. The staff found the applicant's LRA AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions as described above.

Operating Experience. In LRA Section B2.1.7, the applicant stated that it implements the BWR Control Rod Drive Return Line Nozzle Program inspections through the Inservice Inspection Program, which incorporates applicable requirements of the ASME Code. The inspection and testing methodologies have been effective in detecting aging effects due to cracking. Engineering evaluations were performed based on plant and industry experience and component and programmatic corrective actions implemented as required. For example, in 1977 the CRDRL nozzle safe end was removed and the CRDRL nozzle was capped. In 1986, the CRDRL nozzle was modified again by removing the portion of the existing weld butter layer susceptible to IGSCC by re-cladding the weld prep area with corrosion-resistant cladding, and by installing a new nozzle cap. As a result of capping the CRDRL nozzle as discussed above, the NUREG-0619 augmented examinations are no longer required.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's BWR CRDRL Nozzle Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.7, the applicant provided the USAR supplement for the BWR CRDRL Nozzle Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's BWR CRDRL Nozzle Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 BWR Feedwater Nozzle Program

Summary of Technical Information in the Application. In LRA Section B2.1.8, the applicant described the BWR Feedwater Nozzle Program, stating that this existing program is consistent, with enhancements, with GALL AMP XI.M5, "BWR Feedwater Nozzle." The MNGP BWR Feedwater Nozzle Program is part of the MNGP ASME Section XI In-Service Inspection Program. The BWR Feedwater Nozzle Program is in accordance with the ASME Code, Section XI, 1995 edition through the 1996 addenda, with Appendix VIII. The program provides for condition monitoring of the BWR FW nozzles. The BWR FW nozzles were all repaired in 1977 and the safe ends were all replaced in 1981 with a tuning fork design with a welded-in thermal sleeve. The BWR Feedwater Nozzle Program is not currently augmented by the recommendations of General Electric (GE) Topical Report NE-523-A71-0594, Revision 1, "Alternate BWR Feedwater Nozzle Inspection Requirement." The applicant will enhance the program by including the recommendations of GE-NE-523-A71-0594-A, Revision 1. The applicant updates the program periodically as required by 10 CFR 50.55a.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses consistency of the AMP elements with GALL AMP XI.M5.

During the audit and review, the staff asked the applicant whether its current approved ISI relief requests or code cases affect any of its AMP program elements.

In its letter dated August 31, 2005, the applicant identified the following additional exception to the GALL Report program element.

Exception: The GALL Report recommends for the Corrective Actions program element associated with the exception taken:

> Repair is in conformance with IWB-4000 and replacement in accordance with IWB-7000.

In its letter dated August 11, 2005, the applicant stated that an approved alternative allows the use of the ASME Code, Section XI, 2001 edition in lieu of the 1995 edition with the 1996 addenda for repair/replacement activities.

The staff concluded that this item is not an exception and that with regard to this item, the affected program element is consistent with the GALL Report. SER Section 3.0.3.1.7 documents the staff's evaluation.

In the LRA, the applicant described the following enhancement in meeting the GALL Report elements.

Enhancement: The GALL Report recommends the following for the Parameters Monitored or Inspected, Detection of Aging Effects, and Monitoring and Trending program elements associated with the enhancement made:

> The aging management program (AMP) monitors the effects of cracking on the intended function of the component by detection and sizing of cracks by ISI in accordance with ASME Section XI, Subsection IWB and the recommendation of GE NE-523-A71-0594, as described below.
>
> The extent and schedule of the inspection prescribed by the program are designed to ensure that aging effects will be discovered and repaired before the loss of intended function of the component. Inspection can reveal crack initiation and growth. GE NE-523-A71-0594 specifies ultrasonic testing (UT) of specific regions of the blend radius and bore. The UT examination techniques and personnel qualifications are in accordance with the guidelines of GE NE-523-A71-0594. Based on the inspection method and techniques and plant-specific fracture mechanics assessments, the inspection schedule is in accordance with Table 6-1 of GE NE-523-A71-0594. Leakage monitoring may be used to modify the inspection interval.
>
> Inspections scheduled in accordance with GE NE-523-A71-0594 provide timely detection of cracks.

In the LRA, the applicant stated that it will enhance the BWR Feedwater Nozzle Program by including the recommendations of GE-NE-523-A71-0594-A, Revision 1.

By letter dated September 24, 1999, the BWR Owners Group (BWROG) submitted for staff review Topical Report GE-NE-523-A71-0594-A, Revision 1. This report proposed an alternative to the recommendations of NUREG-0619. The topical report proposed to (1) accept the UT as the basis to eliminate supplemental liquid PT of inside radii of the RPV nozzles, (2) lengthen the time interval between routine UT of inside radii of the RPV nozzles, and (3) reduce the inspection area of inside radii of the RPV nozzles. In its review of the topical report, the staff focused on the quality and reliability of the UT examinations. In its letter to BWROG, dated March 10, 2000, the staff approved the proposed inspection program and schedule as described in the BWROG topical report; therefore, GE-NE-523-A71-0594-A, Revision 1, is an acceptable alternative to the NUREG-0619 inspection guidelines.

The applicant stated that it had made four long-term inspection commitments based on NUREG-0619 in 1989, as follows:

(1) Review online FW nozzle thermal sleeve leak detection system data monthly.

(2) Perform external UT examinations on two of the four FW nozzles each refueling outage.

(3) Perform visual inspections of the spargers and the nozzle blend radius areas of all four FW nozzles each refueling outage.

(4) Perform PT examinations of nozzles at the next appropriate opportunity in the event that (a) UT examinations indicate a flaw or (b) online leakage monitoring systems identify excessive leakage (greater than 0.3 gallons per minute).

In the corresponding SER, the staff stated that MNGP will continue inspections for "9 inspection interval-refueling cycles or 135 startup/shutdown cycles" as stated in NUREG-0619. The inspection interval began with the installation of welded thermal sleeves during the 1981 refueling outage. With the completion of inspections during the 1998 refueling outage, the applicant had completed the required nine inspection interval-refueling cycles with no observed degradation of the FW nozzles. The most recent FW nozzle inspections during the third 10-year ASME Section XI In-Service Inspection Program (ending on May 1, 2003) also revealed no cracking on these nozzles.

During the audit and review, the staff asked the applicant to clarify plans to update its current BWR Feedwater Nozzle Program to meet the recommendations in GE-NE-523-A71-0594, Revision 1. The applicant stated that (1) the requirement specified in ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D, for full-penetration welded nozzles has been incorporated into the BWR Feedwater Nozzle Program, (2) the region inspected, examination techniques, and personnel qualifications will be consistent with the recommendations of GE-NE-523-A71-0594, Revision 1, Section 4.0, and (3) the requirement of Appendix VIII to ASME Code, Section XI, including IWB-2400 schedule requirements has been incorporated into the BWR Feedwater Nozzle Program, which will be enhanced for consistency with the recommendations of GE-NE-523-A71-0594, Revision 1, Sections 6.2 and 6.3. If defects are detected, the applicant will expand the scope of examinations pursuant to the requirements of IWB-2430. The staff found this enhancement acceptable because the associated recommendations are based on (1) the availability of the proven improved UT techniques, (2) meeting the inspection commitments made in 1989, (3) acceptable performance history of the FW nozzles with the new thermal sleeves, and (4) the staff's approval of use of GE-NE-523-A71-0594, Revision 1.

On the basis of its review of the above enhancement and discussions with the applicant's technical personnel, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of AMP B2.1.8, "BWR Feedwater Nozzle Program," that the applicant claimed are consistent with GALL AMP XI.M5 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exception and enhancement as described above.

Operating Experience. In LRA Section B2.1.8, the applicant explained that it performed engineering evaluations based on plant and industry experience and component and programmatic corrective actions implemented as required:

- Repairs were made to the FW nozzles and safe ends in 1977 to minimize damage to the FW nozzles due to thermal cycling. Cladding was removed from the nozzle blend radius and bore, and an FW sparger interference fit thermal sleeve with a piston ring seal was installed.
- New FW nozzle safe ends were installed in 1981. These safe ends have a tuning fork design with a welded-in thermal sleeve and provide a significant reduction in thermal cycling.
- The applicant incorporated considerations from NUREG-0619, along with NRC GL 81-11, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking (NUREG-0619)," dated February 29, 1981, into the BWR Feedwater Nozzle Program during the third 10-year inspection interval ending on May 1, 2003. No cracking was identified as a result of these inspections.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's BWR Feedwater Nozzle Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.8, the applicant provided the USAR supplement for the BWR Feedwater Nozzle Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant added the following three commitments to USAR Section A2.1.8, documented as commitments 18–20 in Table A.5, that it will complete before the period of extended operation:

(1) The parameters monitored and inspected are consistent with the recommendations of GE-NE-523-A71-0594-A, Revision 1.

(2) The regions being inspected, examination techniques, personnel qualifications, and inspection schedule are consistent with the recommendations of GE-NE-523-A71-0594-A, Revision 1.

(3) The applicant will schedule inspections per recommendations of GE-NE-523-A71-0594-A, Revision 1.

The BWR Feedwater Nozzle Program is not currently augmented by the recommendations of GE-NE-523-A71-0594. The applicant will enhance the program by including the recommendations of GE-NE-523-A71-0594-A, Revision 1. The applicant updates this program periodically as required by 10 CFR 50.55a.

Conclusion. On the basis of its review and audit of the applicant's BWR Feedwater Nozzle Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 BWR Penetrations Program

Summary of Technical Information in the Application. In LRA Section B2.1.9, the applicant described the BWR Penetrations Program, stating that this existing program is consistent, with exceptions, with GALL AMP XI.M8, "BWR Penetrations." The MNGP BWR Penetrations Program is part of the MNGP ASME Section XI In-Service Inspection Program. The BWR Penetrations Program is in accordance with the ASME Code, Section XI, 1995 edition through the 1996 addenda (with approved ISI relief requests) and provides for condition monitoring of the BWR penetrations. The BWR water chemistry is controlled in accordance with the EPRI guidelines of BWRVIP-130 (TR-1008192), "BWR Water Chemistry Guidelines—2004 Revision." This document supersedes previous revisions of the guidelines, including BWRVIP-29 (TR-103515), "BWR Water Chemistry Guidelines—1993 Revision." Program activities at MNGP incorporate the inspection and evaluation guidelines of BWRVIP-49, "BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines," for instrument penetrations and BWRVIP-27, "BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate DP Inspection and Flaw Evaluation Guidelines," for the standby liquid control (SLC) system. The applicant updates the program periodically as required by 10 CFR 50.55a and the BWRVIP.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses consistency of the AMP elements with GALL AMP XI.M8.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M8 in the GALL Report.

Exception 1: The GALL Report recommends the following for the program description associated with of the exception taken:

> The program includes monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-29 (Electric Power Research [EPRI] TR-103515) to ensure the long-term integrity and safe operation of boiling water reactor (BWR) vessel internal components.

The GALL Report recommends the following for the Preventive Actions program element associated with the exception taken:

> Maintaining high water purity reduces susceptibility to SCC or IGSCC, and reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515).

In the LRA, the applicant stated that it controls BWR water chemistry using BWRVIP-130 instead of the guidelines in BWRVIP-29 recommended by the GALL Report.

The staff evaluated this exception as part of the Plant Chemistry Program. SER Section 3.0.3.2.19 documents the Plant Chemistry Program description, evaluation, and technical basis for monitoring reactor water chemistry.

The applicant stated, in the LRA, that its BWR Penetrations Program is "in accordance with ASME Section XI, 1995 Edition through 1996 Addenda (with approved ISI relief requests)."

During the audit and review, the staff asked the applicant whether its current approved ISI relief requests or code cases affect any of its AMP elements. In its response, by letter dated August 31, 2005, the applicant identified the following additional exception to the GALL Report program elements.

Exception 2: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the identified exception:

> Instrument penetrations and SLC system nozzles or housings are inspected in accordance with the requirements of ASME Section XI, Subsection IWB. Components are examined and tested as specified in Table IWB-2500-1, examination categories B-E for pressure-retaining partial penetration welds in vessel penetrations, B-D for full penetration nozzle-to-vessel welds, B-F for pressure-retaining-dissimilar metal nozzle-to-safe-end welds, or B-J for similar metal nozzle-to-safe end welds. In addition, these components are part of examination category B-P for pressure-retaining boundary.

In its letter dated August 11, 2005, the applicant stated that its BWR Penetrations Program will deviate from ASME Code, Section XI, Table IWB–2500-1 and Figure IWB-2500-7(b) requirements in terms of the examination volume for Category B-D components.

In its evaluation of the effects of current approved ISI relief requests and code cases, the applicant stated that during the current ISI inspection interval, which will extend approximately 21 months into the period of extended operation, examination of Category B-D components

(Full Penetration Welded Nozzles in Vessels) will deviate from the requirements of ASME Code, Section XI, Table IWB-2500-1, Item No. B3.90, and from the requirements of ASME Code, Section XI, Figure IWB-2500-7(b). Specifically, Figure IWB-2500-7(b) requires that a minimum volume of material equal to a distance of one-half the reactor vessel shell thickness (i.e., a distance of approximately 2-1/2 inches) be included in the examination on each side of the weld; however, the BWR Penetrations Program instead will examine a reduced volume of one-half inch of base metal on each side of the widest portion of the weld. The applicant identified this reduction in weld examination volume as an exception to the recommendations of GALL AMP XI.M8. The applicant technically justified the reduction in examination volume as follows:

> The required examination volume for the reactor vessel pressure retaining nozzle-to-vessel welds extends far beyond the weld into the base metal, and is unnecessarily large. The proposed alternative re-defined the examination volume boundary to ½ inch of base metal on each side of the widest portion of the weld, removing from examination the base metal that was extensively examined during prior inspections, and that is not in the high residual stress region associated with the weld.
>
> The creation of flaws during plant service in the volume excluded from the proposed reduced examination is unlikely because of the low stress in the base metal away from the weld. The stresses caused by welding are concentrated at or near the weld. Cracks, should they initiate, occur in the high-stressed areas of the weld. These high-stress areas are contained in the volume that is defined by Code Case N–613-1 and are thus subject to examination. During previous examinations, no indications exceeding the allowable limits of the preservice or inservice criteria were found in the reactor vessel nozzle to shell examination volumes including the base metal areas proposed for exclusion from examination in this request.

In its letter dated August 31, 2005, the applicant stated that it considers the alternative examination of Category B-D welds based on Code Case N–613-1 an exception to the Detection of Aging Effects program element as described in GALL AMP XI.M8. The staff reviewed the applicant's description and technical justification for this exception as summarized in the preceding paragraph. The staff also reviewed the applicant's letter dated February 27, 2004, which provides a similar technical justification and includes tables of previous examination results. Because the examination volume includes the heat-affected regions of base metal around the welds where new cracks are most likely to occur and previous examinations of the base metal beyond the heat-affected regions have not detected any unacceptable indications, the staff concluded that this exception is acceptable.

During the audit and review, the staff noted that in the Detection of Aging Effects program element the applicant referred parenthetically to "risk-informed ISI." Specifically, the first sentence of the Detection of Aging Effects program element reads as follows:

> The detection of aging effects is prescribed by the MNGP BWR Penetrations Program in accordance with the requirements of ASME Section XI, Table IWB-2500-1 for Examination Categories B-D, B-O and B-W and NRC approved alternatives for Categories B-F and B-J (risk-informed ISI (RI-ISI)).

The staff asked the applicant to address the effects of its RI-ISI associated with the Detection of Aging Effects program element.

In its response, by letter dated August 31, 2005, the applicant stated that its implementation of RI-ISI affects the Detection of Aging Effects program element of its BWR Penetrations Program and is an exception to GALL AMP XI.M8.

Exception 3: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the exception:

> Instrument penetrations and SLC system nozzles or housings are inspected in accordance with the requirements of ASME Section XI, Subsection IWB. Components are examined and tested as specified in Table IWB-2500-1, examination categories B-E for pressure-retaining partial penetration welds in vessel penetrations, B-D for full penetration nozzle-to-vessel welds, B-F for pressure-retaining dissimilar metal nozzle-to-safe end welds, or B-J for similar metal nozzle-to-safe-end welds. In addition, these components are part of examination category B-P for pressure-retaining boundary. Further details for examination are described in Chapter XI.M1, "ASME Section XI, In-Service Inspection, Subsection IWB, IWC, and IWD," of this report.

In the LRA, the applicant stated that its ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program will include an RI-ISI methodology as an alternative to the ASME Code, Section XI ISI requirements in terms of (1) the number of locations inspected, (2) the locations inspected, and (3) the method of inspection. This alternative applies to welds in ASME Code, Section XI Categories B-F (Class 1 pressure-retaining dissimilar metal welds in vessel nozzles), B-J (Class 1 pressure-retaining welds in piping), C-F-1 (Class 2 pressure-retaining welds in austenitic stainless steel or high-alloy piping), and C-F-2 (Class 2 pressure-retaining welds in carbon or low-alloy steel piping).

In its letter dated August 31, 2005, the applicant stated that its implementation of RI-ISI during the current inspection interval affects both GALL AMP XI.M1 and GALL AMP XI.M8. The staff's evaluation documented in SER Section 3.0.3.2.2, exception 7, applies to this exception, so the staff concluded that the applicant's implementation of RI-ISI is an acceptable exception for managing applicable component aging effects through the end of the applicant's current ISI inspection interval on May 31, 2012, approximately 21 months into the extended operating period.

On the basis of the review of the above exceptions and of operating experience for the BWR Penetrations Program, the staff found these exceptions acceptable.

The staff reviewed those portions of AMP B2.1.9, "BWR Penetrations Program," that the applicant claimed are consistent with GALL AMP XI.M8 and found them consistent. The staff found the applicant's LRA AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions as described above.

Operating Experience. In LRA Section B2.1.9, the applicant explained that it periodically examines materials within the scope of the BWR Penetrations Program and evaluates them for corrective action as needed. The program incorporates vendor guidance (e.g., BWRVIP-49 and

-27). The applicant has implemented corrective actions to replace materials susceptible to cracking. For example, (1) the SLC nozzle safe end was replaced in 1984 using different materials to resist IGSCC, (2) in 1984 the jet pump instrumentation safe end and penetration seal were replaced with a jet pump instrumentation nozzle penetration seal using 316L stainless steel materials to resist IGSCC, and (3) a corrosion-resistant clad overlay was applied to the inside diameter (ID) of the reactor vessel head vent nozzle (N7) and the reactor vessel head cooling spray nozzles N6A & B (penetrations). The corrosion-resistant clad overlay isolated the IGSCC susceptible weld butter from the reactor coolant.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its evaluation of the applicant's program against the program elements described in the GALL Report AMP, the above industry and plant-specific operating experience, and its discussions with the applicant's technical personnel, the staff concluded that the applicant's BWR Penetrations Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.9, the applicant provided the USAR supplement for the BWR Penetrations Program. The staff noted that this USAR supplement includes parenthetic mention of "approved ISI relief requests." In its letter dated August 31, 2005, the applicant stated that it will delete the reference to ISI relief requests from the USAR supplement description of the BWR Penetrations Program. The staff reviewed this section and determined that the information in the USAR supplement after deletion of the reference to ISI relief requests adequately describes the program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's BWR Penetrations Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 BWR Stress Corrosion Cracking Program

Summary of Technical Information in the Application. In LRA Section B2.1.10, the applicant described the BWR Stress Corrosion Cracking Program, stating that this existing program is consistent, with exception, with GALL AMP XI.M7, "BWR Stress Corrosion Cracking." The applicant is implementing ASME Code, Section XI, with UT volumetric, surface, and visual inspections and the RI-ISI program. The MNGP BWR Stress Corrosion Cracking Program incorporates NUREG-0313 and NRC GL 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," dated January 25, 1988, and its Supplement 1. The applicant has replaced all IGSCC susceptible materials or protected them with a cladding of resistant weld material. Therefore, all piping welds are now classified as IGSCC Category A in accordance with NUREG-0313 and GL 88-01. As part of the MNGP recirculation piping replacement effort, the applicant replaced austenitic stainless steel portions of piping systems 4 inches in nominal diameter or larger operating at temperatures above 200°F of the reactor coolant pressure boundary in accordance with the requirements of NUREG-0313. In addition, a hydrogen water chemistry system now operates, which reduces the oxidizing environment by introducing excess hydrogen to the RCS that combines with the free oxygen produced by radiolysis.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exception and the associated justifications to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M7.

The applicant stated that the LRA mentioned relief requests, including RI-ISI, as parts of the current ASME Code, Section XI programs credited with managing aging effects. The applicant further stated that it did not consider relief requests as exceptions to GALL Report because they are temporary and many will expire before the period of extended operation. The applicant stated that code cases and relief requests related to its ASME Section XI In-Service Inspection, Subsections IWB, IWC, IWD, and IWF Program are valid for approximately 21 months into the period of extended operation and that the current inspection interval ends on May 31, 2012. In addition, the applicant stated that except for one difference related to the Corrective Actions program element, its implementation of RI-ISI and currently approved relief requests affect none of its BWR Stress Corrosion Cracking Program elements. Consequently, as documented in its letter dated August 31, 2005, the applicant stated that it will revise the LRA to delete all references to the RI-ISI program in the BWR Stress Corrosion Cracking Program description.

The staff reviewed the applicant's BWR Stress Corrosion Cracking Program and additional descriptions of its RI-ISI program in the applicant's letter dated December 18, 2001. On the basis of its review, the staff concluded that the RI-ISI program and approved ISI relief requests affect no BWR Stress Corrosion Cracking Program elements. The staff also found that the applicant's change to delete all references to the RI-ISI program in the description of its BWR Stress Corrosion Cracking Program is acceptable.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M7 in the GALL Report.

Exception 1: The GALL Report recommends the following for the Preventive Actions program element associated with the exception taken:

> The program delineated in NUREG-0313 and NRC GL 88-01 does not provide specific guidelines for controlling reactor water chemistry to mitigate IGSCC; however, maintaining high water purity reduces susceptibility to SCC or IGSCC, and reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (Electric Power Research Institute (EPRI) TR-103515).

In the LRA, the applicant stated that it controls BWR water chemistry using BWRVIP-130. This document supersedes previous revisions of the BWR water chemistry guidelines, including BWRVIP-29 referenced in the GALL Report.

The staff evaluated this exception as part of the Plant Chemistry Program. SER Section 3.0.3.2.19 documents the Plant Chemistry Program description, evaluation, and technical basis for monitoring reactor water chemistry.

During the audit and review, the staff asked the applicant whether its current approved ISI relief requests or code cases affect any of its AMP elements. In its letter dated August 31, 2005, the applicant identified the following additional exception to the GALL Report program elements.

Exception 2: The GALL Report recommends the following for the Corrective Actions program element associated with the exception taken:

> The guidance for weld overlay repair and stress improvement or replacement is provided in NRC GL 88-01; ASME Section XI, Subsections IWB-4000 and IWB-7000, IWC-4000 and IWC-7000, or IWD-4000 and IWD-7000, respectively, for Class 1, 2, or 3 components; and ASME Code Case 504-1.

In its letter dated August 11, 2005, the applicant stated that an approved alternative allows the use of the ASME Code, Section XI, 2001 edition in lieu of the 1995 edition with 1996 addenda for repair/replacement activities.

The staff concluded that this alternative is not an exception and that with regard to this item, the affected program element is consistent with the GALL Report. SER Section 3.0.3.1.7 documents the staff's evaluation.

The staff reviewed those portions of AMP B2.1.10, "BWR Stress Corrosion Cracking Program," that the applicant claimed are consistent with GALL AMP XI.M7 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions as described above.

Operating Experience. In LRA Section B2.1.10, the applicant explained that a review of plant operating experience for the BWR Stress Corrosion Cracking Program identified no adverse trends or issues with program performance. The applicant identified problems and corrected them before they caused any significant impact to safe operation, and it took adequate corrective actions to prevent recurrence. The BWR Stress Corrosion Cracking Program effectively detects flaw indications in susceptible components and contains appropriate guidance for evaluation or repair of flaws. As needed, plant staff can adjust the inspection plan based on results to enhance program effectiveness. The applicant performs periodic self-assessments of the program and reviews of industry and plant experience to identify any needed improvements. Examples of corrective actions implemented as a result of program activities include the following:

- In 1984, a corrosion-resistant cladding overlay was applied to the ID of the head vent nozzle and head cooling spray and instrumentation nozzles. The weld overlay of 308L isolated the IGSCC susceptible existing weld butter located in the weld residual stress area from the reactor coolant.

- In 1984, the recirculation inlet safe ends and thermal sleeve assembly and the recirculation outlet safe ends were replaced using nuclear-grade stainless steel materials to resist IGSCC.
- In 1986, new CSP nozzle safe ends featuring a tuning fork design with a thermal sleeve were installed. The applicant performed this modification to minimize IGSCC in the CSP system.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its evaluation of the applicant's program against the program elements described in the GALL Report AMP, the above industry and plant-specific operating experience, and discussions with the applicant's technical personnel, the staff concluded that the applicant's BWR Stress Corrosion Cracking Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.10, the applicant provided the USAR supplement for the BWR Stress Corrosion Cracking Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d). The staff noted that this USAR supplement describes "the risk-informed ISI program" in the same way as in the applicant's statement on consistency with the GALL Report. In its August 31, 2005, letter the applicant stated that it will delete the reference to the RI-ISI program from the USAR supplement description of the BWR Stress Corrosion Cracking Program.

Conclusion. On the basis of its review and audit of the applicant's BWR Stress Corrosion Cracking Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exception and the associated justifications and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 BWR Vessel ID Attachment Welds Program

Summary of Technical Information in the Application. In LRA Section B2.1.11, the applicant described the BWR Vessel ID Attachment Welds Program, stating that this existing program is consistent, with exception, with GALL AMP XI.M4, "BWR Vessel ID Attachment Welds." The MNGP BWR Vessel ID Attachment Welds Program is part of the MNGP ASME Section XI In-Service Inspection AMP. The BWR Vessel ID Attachment Weld Program is in accordance with the ASME Code, Section XI, 1995 edition through the 1996 addenda and approved ISI relief requests. The program provides for condition monitoring of the BWR vessel ID attachment welds. It includes inspection and flaw evaluation in accordance with BWRVIP-48 (EPRI TR-108724), "Vessel ID Attachment Weld and Inspection and Flaw Guidelines.". The

BWR water chemistry is controlled in accordance with the EPRI guidelines of BWRVIP-130". The applicant updates the program periodically as required by 10 CFR 50.55a, and supplements it by implementing the guidelines of the BWRVIP documents.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exception and the associated justifications to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M4.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.M4 in the GALL Report.

Exception 1: The GALL Report recommends the following for the Preventive Actions program element associated with the exception taken:

> The BWRVIP-48 provides guidance on detection, but does not provide guidance on methods to mitigate cracking. Maintaining high water purity reduces susceptibility to SCC or IGSCC. Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515). The program description and evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in Section XI.M2, "Water Chemistry."

In the LRA, the applicant stated that it controls the BWR water chemistry using BWRVIP-130 instead of the guidelines in BWRVIP-29 recommended by the GALL Report.

The staff found this exception acceptable. SER Section 3.0.3.2.19, Exception 1, documents the staff's evaluation.

During the audit and review, the staff asked the applicant to address whether its current approved ISI relief requests or code cases affect any of its AMP program elements. In its letter dated August 31, 2005, the applicant identified the following additional exception to the GALL Report program elements.

Exception 2: The GALL Report recommends the following for the Corrective Actions program element associated with the exception taken:

> Repair and replacement procedures are equivalent to those requirements in the ASME Section XI. Repair is in conformance with IWB-4000 and replacement occurs according to IWB-7000. As discussed in the appendix to this report, the staff found that licensee implementation of the guidelines in BWRVIP-48, as modified, will provide an acceptable level of quality for inspection and flaw evaluation of the safety-related components addressed in accordance with 10 CFR Part 50, Appendix B, corrective actions.

In its letter dated August 11, 2005, the applicant stated that an approved alternative allows the use of the ASME Code, Section XI, 2001 edition in lieu of the 1995 edition with the 1996 addenda for repair/replacement activities.

The staff concluded that this alternative is not an exception and that with regard to this item, the affected program element is consistent with the GALL Report. SER Section 3.0.3.1.7 documents the staff's evaluation.

The staff reviewed those portions of AMP B2.1.11, "BWR Vessel ID Attachment Welds Program," that the applicant claimed are consistent with GALL AMP XI.M4 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions as described above.

Operating Experience. In LRA Section B2.1.11, the applicant explained that it performed the engineering evaluations based on plant and industry experience and implemented component and programmatic corrective actions as required. For example, a vendor notification discussed the susceptibility of Alloy 182 welds to IGSCC/interdendritic SCC in shroud support structures such as those used in the MNGP vessel and shroud. BWRVIP-38, "BWR Shroud Support Inspection and Flaw Evaluation Guidelines," provides guidance on the inspection of the shroud support structure. The 2000 outage included inspection of the recommended 10-percent portions of the H8 and H9 welds using enhanced visual examination (EVT)-1 techniques around the access holes at the 0 and 180 degree locations. No indications were found. In addition, the applicant inspected 14 shroud support legs using a VT-3 technique because of flaw indications found on the initially examined support leg. The applicant continues to inspect the H8 and H9 welds in accordance with BWRVIP-38 but has found no operability impacts.

The staff reviewed the applicant's operating experience evaluation for the BWR Vessel ID Attachment Welds Program and interviewed the applicant's program manager for this program to confirm that plant-specific operating experience revealed no degradation not identified by industry experience.

On the basis its evaluation of the applicant's program against the program elements described in the GALL Report AMP, review of the above industry and plant-specific operating experience, and discussions with the applicant's technical personnel, the staff concluded that the applicant's BWR Vessel ID Attachment Welds Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.11, the applicant provided the USAR supplement for the BWR Vessel ID Attachment Welds Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d). The staff noted that this USAR supplement mentions "approved ISI relief requests." In its August 31, 2005, letter the applicant stated that it will delete the reference to ISI relief requests from the USAR supplement description of the BWR Vessel ID Attachment Welds Program.

Conclusion. On the basis of its review and audit of the applicant's BWR Vessel ID Attachment Welds Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exception and the associated justifications and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 BWR Vessel Internals Program

Summary of Technical Information in the Application. In LRA Section B2.1.12, the applicant described the BWR Vessel Internals Program, stating that this existing program is consistent, with exception and enhancement, with GALL AMP XI.M9, "BWR Vessel Internals." The BWR Vessel Internals Program is part of the ASME Section XI In-Service Inspection Program. The BWR Vessel Internals Program is in accordance with the ASME Code, Section XI, 1995 edition through the 1996 addenda and approved ISI relief requests. The program provides for condition monitoring of the BWR vessel internals for crack initiation and growth. MNGP activities include in-vessel examination procedures and plant water chemistry procedures. The in-vessel examination procedures implement the recommendations of the BWRVIP guidelines, as well as the requirements of the ASME Code, Section XI. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits based on the EPRI guidelines in BWRVIP-130." This document supersedes previous revisions of the BWR water chemistry guidelines, including BWRVIP-29. The applicant updates this program periodically as required by 10 CFR 50.55a and the BWRVIP program.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exception and enhancement and the associated justifications to determine whether the AMP, with the exception and enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M9.

During the audit and review, the staff noted that, in the LRA, the applicant's program description stated that the BWR Vessel Internals Program is "in accordance with ASME Section XI 1995 Edition through 1996 Addenda and approved ISI relief requests." The staff asked that the applicant clarify the phrase "and approved ISI relief requests." In its letter dated August 11, 2005, the applicant stated that the LRA mentions relief requests because they are parts of the current ASME Code, Section XI programs credited with managing aging effects. The applicant further stated that it did not consider relief requests as exceptions to the GALL Report because they are temporary and many expire before the period of extended operation. The applicant stated that code cases and relief requests of its ASME Section XI In-Service Inspection, Subsections IWB, IWC, IWD and IWF Program are valid for approximately 21 months into the period of extended operation and that the current inspection interval ends on May 31, 2012.

The applicant stated that none of its approved ISI relief requests affect any of the program elements of the BWR Vessel Internals Program. Subsequently, as documented in its letter dated August 31, 2005, the applicant revised the LRA to delete all references to ISI relief requests in the description of the BWR Vessel Internals Program. Upon review of the applicant's evaluation of program elements against the approved relief requests, the staff found that no approved ISI relief requests affect any BWR Vessel Internals Program element. On this basis, the staff also found the applicant's revision to delete all references to ISI relief requests in the description of its BWR Vessel Internals Program acceptable.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.M9 in the GALL Report.

Exception: The GALL Report recommends the following for the Preventive Actions program element associated with the exception taken:

> Maintaining high water purity reduces susceptibility to cracking due to SSC or IGSCC. Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515). The program description and evaluation, and technical basis of monitoring and maintaining reactor water chemistry are presented in Chapter XI.M2, "Water Chemistry."

In the LRA, the applicant stated that it controls the BWR water chemistry using BWRVIP-130 instead of the guidelines in BWRVIP-29 recommended by the GALL Report.

The staff found this exception acceptable. SER Section 3.0.3.2.19, Exception 1, documents the staff's evaluation.

In the LRA, the applicant stated that the following enhancement will make this AMP consistent with the recommendation in the GALL Report.

Enhancement: The GALL Report recommends the following for the Scope of Program program element associated with the enhancement made:

> The BWRVIP documents provide generic guidelines intended to present the applicable inspection recommendations to assure safety function integrity of the subject safety-related reactor pressure vessel internal components...
>
> The various applicable BWRVIP guidelines are as follows:
>
>> Core shroud: BWRVIPs -07, -63, and -76; and BWRVIP-02, Rev. 2.
>>
>> Core plate: BWRVIP-25; BWRVIP-50.
>>
>> Shroud support: BWRVIP-38; BWRVIP-52.
>>
>> Low-pressure coolant injection (LPCI) coupling: BWRVIP-42; BWRVIP-56.
>>
>> Top guide: BWRVIP-26; BWRVIP-50.
>>
>> Core spray: BWRVIP-18; BWRVIP-16 and BWRVIP-19.
>>
>> Jet pump assembly: BWRVIP-41; BWRVIP-51.

Control rod drive (CRD) housing: BWRVIP-47; BWRVIP-58.

Lower plenum: BWRVIP-47; BWRVIP-57.

Steam Dryer: BWRVIP-139

For each component or assembly, the first listed BWRVIP document provides guidelines for inspection and evaluation and the second, or last, listed provides guidelines for repair design criteria.

In addition, BWRVIP-44 provides guidelines for weld repair of nickel alloys, and BWRVIP-45 provides guidelines for weldability of irradiated structural components.

In the LRA, the applicant stated that it will add the repair/replacement guidelines in BWRVIP-16, -19, -44, -45, -50, -51, -52, -57, and -58, as applicable, to its BWR Vessel Internals Program.

The applicant stated in the LRA that the enhancement is required to satisfy the GALL Report AMP recommendations and that the enhancement is scheduled for completion before the period of extended operation. The staff found that the addition of the listed BWRVIP documents is an appropriate enhancement to the applicant's current program that will make the applicant's BWR Vessel Internals Program consistent with the recommendations of the GALL Report during the period of extended operation.

The staff asked the applicant to verify that it will implement the applicable BWRVIP guidelines during the period of extended operation. In response, the applicant provided the following description of its conformance with industry commitments for implementation of the BWRVIP guidelines:

> In a letter dated May 30, 1997, from Carl Terry (Niagara Mohawk Power Company, Chairman of BWR Vessel and Internals Project) to Brian Sheron (NRC), the BWRVIP member utilities commitments were expressed. The letter stated, 'We will implement the BWRVIP products at each of our plants as appropriate considering individual plant schedules, configurations and needs.' One such document is BWRVIP-94, Program Implementation Guide. BWRVIP-94 states that each member utility, of which Monticello/NMC is, will implement the BWRVIP guidelines to the fullest extent possible.

Because the applicant's implementation documents indicate a very high degree of conformance to BWRVIP guidelines, the staff considered this response acceptable. Additionally, in its letter, dated March 15, 2006, the applicant submitted commitment 57, which states that NMC is an active member of the BWRVIP and will continue to follow applicable inspection guidelines and recommendations that the executive committee of the BWRVIP has reviewed and approved throughout the period of extended operation.

SER Section 4.8 discusses the staff's review of the impact of the time-limited aging analysis (TLAA) of the reactor internals core plate holddown bolts. During review of the issues, the staff requested that the applicant identify the results from the baseline inspections recommended for the core plate holddown bolts in BWRVIP-25 (TR-107284), "BWR Core Plate Inspection and Flaw Evaluation Guidelines," issued December 1996. The applicant stated that it had not yet completed the recommended inspections because tooling had not been developed to perform the inspections. Therefore, the staff requested that the applicant complete this action before entering the period of extended operation. If tooling is not available, the applicant could use wedges that provide lateral restraint for the core plate, or propose alternative inspection methods that the staff will review and approve. In its letter dated March 31, 2006, the applicant provided commitment 60 in Appendix A, stating that before the period of extended operation, it would either inspect the core plate holddown bolts in accordance with the BWRVIP inspection guidelines, install the core plate wedges, or develop an alternative to the inspections identified in BWRVIP-25 and submit it to the staff for review and approval. The staff found this response acceptable because it is consistent with the inspection guidelines described in BWRVIP-25.

The staff reviewed those portions of the AMP B2.1.12, "BWR Vessel Internals Program," that the applicant claimed are consistent with GALL AMP XI.M9 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exception and enhancement described above.

During the aging management inspection, the inspectors identified that additional changes were necessary to ensure that the applicant adequately managed plant aging effects relating to reactor vessel internals in accordance with the AMP.

The inspectors noted that incore monitoring instrument dry tubes are within the scope of the AMP. However, these tubes are not subject to periodic inspections under the applicant's AMP that credits the BWRVIP-130 BWR water chemistry guidelines and the ASME Code, Section XI inspection programs. Because these tubes are subject to radiation-induced damage above the threshold for irradiation-assisted SCC (IASCC), they could crack and cause pressure boundary leakage. Operating experience for GALL AMP XI.M9 identified that cracking has been observed at other BWRs. Furthermore, GE Service Information Letter (SIL)-409, "Incore Dry Tube Cracks," recommended periodic (every other outage) visual examinations focused on the upper 2 feet of the tube to detect cracking. The applicant voluntarily implemented these examinations for the current license; however, the applicant had not committed to continue with these examinations during the period of extended operation. The applicant stated that the next annual LRA revision will incorporate into its AMP the examinations of incore monitoring instrument dry tubes recommended in GE SIL-409. In its letter, dated March 15, 2006, the applicant provided commitment 56 in Table A.5, which states that NMC has inspected the incore monitoring dry tubes at every other refueling outage and will continue to perform this inspection during the period of extended operation, in accordance with the guidance provided in GE SIL-409. The staff found the applicant's response acceptable because it ensures that aging effects for the dry tubes will be adequately managed during the period of extended operation.

The inspectors determined that the steam dryer was within the scope of license renewal for its structural function, and the applicant conducted periodic inspection of steam dryer welds potentially subject to cracking. The applicant submitted the LRA before the issuance of the BWRVIP inspection program guidance defined in BWRVIP-139, "Steam Dryer Inspection and Flaw Evaluation Guidelines." The applicant stated that the next annual LRA revision would incorporate the BWRVIP-139 steam dryer weld examinations into the AMP. In its letter, dated March 15, 2006, the applicant provided commitment 58 in Table A.5, which states that NMC will follow the guidance provided in BWRVIP-139 for the MNGP steam dryer inspections. The staff found the applicant's response acceptable because BWRVIP-139 provides specific guidelines to ensure that cracking of the steam dryer will be adequately managed during the period of extended operation.

In CAP 014359 (CR 20000209), the applicant documented that during the 2000 refueling outage, areas of the steam dryer in close proximity to the main steam (MST) nozzles appeared polished and that this wear could be caused by steam impingement. The applicant also documented in AR 000032 that Vermont Yankee, with an identical steam dryer design, had observed evidence of steam erosion at the underside of the steam dryer. To evaluate if steam erosion was occurring, a degradation mechanism not identified for the steam dryer in GALL AMP XI.M9, the applicant stated that it will reinspect the affected areas of the MNGP steam dryer during the next refueling outage. The evaluation of the areas will determine if erosion is an aging mechanism that needs to be managed.

The inspectors also identified that in LRA Table B1.6-11, the applicant stated that the internal CSP piping welds P1, P2, and P3 were not inspected in accordance with BWRVIP-18, "Core Spray Internals Inspection and Flaw Evaluation Guidelines," because mechanical clamps were installed to ensure the structural integrity of the sparger T-box welds, and that a visual inspection was conducted each outage to confirm that T-box integrity was maintained. Specifically, the applicant performed a general visual examination (VT-3) of the mechanical clamp repair hardware installed around the welds, instead of an enhanced visual examination (EVT-1) of the welds.

BWRVIP-18 does not require examination of repaired CSP pipe welds unless the integrity of the repair depends upon these welds. The inspectors noted that if cracks develop in the noninspected CSP piping welds P1, P2, and P3, a cooling water flow diversion path would exist outside the core shroud that could adversely affect the applicant's peak fuel clad temperature analysis. Because the applicant's primary clad temperature analysis relied, to some extent, on the leakage integrity for these repaired welds, the inspectors determined that these welds should be inspected using EVT-1 methods to meet BWRVIP-18 requirements. Therefore, the inspectors concluded that the applicant had deviated from the BWRVIP-18 guidance and that this deviation should be identified as an exception to the GALL Report. The applicant stated that it will change the LRA to remove statements about not inspecting these welds during the next annual LRA revision, and that it will also change the applicable inspection procedures to implement enhanced visual examinations of these welds. In its letter, dated March 15, 2006, the applicant provided commitment 59 in Table A.5, which states that NMC will add inspection requirements for the P1, P2, and P3 CSP piping welds in accordance with guidance provided in BWRVIP-18, or subsequent revisions. The staff found the applicant's response acceptable because it will ensure that aging effects that might impact the welds will be adequately managed in accordance with the guidance in BWRVIP-18.

Operating Experience. In LRA Section B2.1.12, the applicant explained that the BWR Vessel Internals Program is based on inspection requirements contained in plant procedures, which incorporate the requirements of the ASME Code. Further, the ASME Code inspections are enhanced with inspections requirements consistent with the BWRVIP. The inspection and testing methodologies have been effective in detecting aging effects due to crack initiation and growth. As shown in the following examples, the applicant performed engineering evaluations based on plant and industry experience and implemented component and programmatic corrective actions as required:

- In 2003, UT inspection of the CSP line found cracking in the CSP piping slip joint welds. The previous evaluation was determined to bound the current flaw size, and no further action was necessary.
- In 1994, mechanical clamps were installed on both of the in-vessel tee box assemblies for the CSP sparger loops A and B. This modification provided a permanent fix that mitigates the crack in the CSP in-vessel lateral header and ensures the CSP system's safety function.
- In 1994, visual inspection of the jet pumps during the refueling outage revealed cracking of tack welds on the jet pump restrainer bracket adjusting screws. The cracking was attributed to high cycle fatigue from jet pump vibration. The applicant added new tack welds to the jet pumps restrainer bracket adjusting screws.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its evaluation of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's BWR Vessel Internals Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.12, the applicant provided the USAR supplement for the BWR Vessel Internals Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

The staff noted that this USAR supplement also mentions "approved ISI relief requests." In its letter, dated August 31, 2005, the applicant stated that it will delete the reference to ISI relief requests from the USAR supplement description of the BWR Vessel Internals Program.

In its letter, dated June 10, 2005, the applicant committed to add the repair/replacement guidelines in BWRVIP-16, -19, -44, -45, -50, -51, -52, -57, and -58, as applicable, to the BWR Vessel Internals Program before the period of extended operation. In addition, during the period of extended operation, the applicant committed to add top guide grid inspections using the EVT-1 method of examination for the high fluence locations (grid beam and beam-to-beam crevice slot locations with fluence exceeding 5.0×10^{20} neutrons per square centimeter (n/cm^2)). The applicant will inspect 10 percent of the total population within 12 years, with a minimum of 5 percent inspected within the first 6 years.

Conclusion. On the basis of its review and audit of the applicant's BWR Vessel Internals Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exception and the associated justifications and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff also reviewed the enhancement and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Closed-Cycle Cooling Water System Program

Summary of Technical Information in the Application. In LRA Section B2.1.13, the applicant described the Closed-Cycle Cooling Water (CCCW) System Program, stating that this existing program is consistent, with exceptions and enhancement, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System." The MNGP CCCW System Program includes (1) preventive measures to minimize corrosion and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm that intended functions are met. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters, such as pH, in accordance with the guidelines of EPRI TR-1007820, "Closed Cooling Water Chemistry Guideline," vendor recommendations, and plant operating experience. EPRI TR-1007820 is the current revision (Revision 1) of EPRI-107396, "Closed Cooling Water Chemistry Guidelines." As the applicant made only minor changes to the MNGP CCCW System Program to implement EPRI TR-1007820, the program is also still in accordance with the EPRI Revision 0 guidelines identified in GALL AMP XI.M21 (i.e., EPRI TR-107396). The applicant also performs periodic inspection and testing to confirm function and monitor corrosion, in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant operating experience. A review of plant operating experience demonstrates these measures ensure CCCW systems are performing their intended functions.

The applicant has four systems within the scope of license renewal meeting the definition for consideration as CCCW systems and portions of three additional systems (heat exchangers or coolers) serviced directly by these cooling water systems. These systems and portions of systems are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not rejected directly to a heat sink. The adequacy of chemistry control is confirmed by routine sampling and monitoring for established limits and by equipment performance monitoring to identify aging effects. Corrosion inhibitor concentrations are maintained within limits based on a combination of EPRI TR-1007820 guidelines, vendor recommendations, and plant experience. System and component performance test results are evaluated in accordance with EPRI TR-1007820 guidelines and used as a basis for evaluating the effectiveness of actions to mitigate cracking, corrosion, and heat exchanger fouling. Acceptance criteria and tolerances are also based on system design parameters and functions. Many chemical parameters monitored are based on ranges identical to or more restrictive than those noted in both EPRI TR-1007820 and EPRI TR-107396. Others are based on vendor recommendations and plant experience. The frequency of performance and functional tests is consistent with EPRI TR-1007820 and based on plant operating experience, trends, and equipment performance. System and component operability tests are typically more frequent than once per cycle, whereas more intrusive inspections (e.g., disassembly, eddy current testing) are performed less frequently.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and enhancement and the associated justifications to determine whether the AMP, with the exceptions and enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M21.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M21 in the GALL Report.

Exception 1: The GALL Report recommends the following for the Scope of Program program element associated with the exception taken:

> A CCCW system is defined as part of the service water system that is not subject to significant sources of contamination, in which water chemistry is controlled and in which heat is not directly rejected to a heat sink. The program described in this section applies only to such a system. If one or more of these conditions are not satisfied, the system is to be considered an open-cycle cooling water system. The staff notes that if the adequacy of cooling water chemistry control can not be confirmed, the system is treated as an open-cycle system as indicated in Action III of Generic Letter (GL) 89-13.

In the LRA, the applicant stated that its CCCW System Program uses EPRI TR-1007820, not EPRI TR-107396, as recommended by the GALL Report. EPRI TR-1007820 is the current revision (Revision 1) of EPRI TR-107396.

The GALL Report recommends using EPRI TR-107396 to monitor for corrosion effects. The applicant uses EPRI TR-1007820, the revision of the same EPRI technical report. The staff reviewed the EPRI TR-107396 standards, compared them to EPRI TR-1007820, and noted that these EPRI reports contain both control and diagnostic parameters. EPRI defines control parameters (e.g., pH, conductivity, or corrosion inhibitor concentration) as those that have an immediate effect on corrosion and strict adherence to them is expected. EPRI defines diagnostic parameters as those that provide baseline information on system conditions or that assist in problem troubleshooting and adherence to them is suggested. EPRI based the changes made to TR-1007820 on industry experience updated since the original EPRI technical report. The staff noted that the control parameters of the newer EPRI TR-1007820 are either the same as or more conservative than those in the older EPRI TR-107396. On the basis of this comparison, the staff determined that no technical concerns are associated with the use of EPRI TR-1007820 and found the exception acceptable.

Exception 2: The GALL Report recommends the following for the Preventive Actions program element associated with the exception taken:

> The program relies on the use of appropriate materials, lining, or coating to protect the underlying metal surfaces and maintenance of system corrosion inhibitor concentrations within specified limits of EPRI TR-107396 to minimize corrosion. The program includes monitoring and control of cooling water chemistry to minimize exposure to aggressive environments and application of

corrosion inhibitor in the CCCW system to mitigate general, crevice, and pitting corrosion.

In the LRA, the applicant stated that the Closed-Cycle Cooling Water System Program does not include some of the chemical parameters recommended for routine monitoring by EPRI TR-1007820 and EPRI TR-107396. Chosen parameters are deemed adequate based on a combination of system design features (which preclude the need for monitoring some chemicals), makeup water source requirements, EPRI TR-1007820 guidelines, vendor recommendations, and plant operating experience.

The applicant stated in the LRA that it monitors most of the chemical parameters recommended by the GALL Report and EPRI TR-1007820 in the closed-cycle cooling systems. The applicant also stated that system design precludes any need to monitor several of these parameters, and operating and inspection activities preclude the need to monitor others. The staff noted that the LRA indicates the specific parameters monitored or excluded for the inhibitor type of each CCCW system, and the PBD itemizes them on a parameter basis.

The staff concluded that the parameters that the applicant monitored in its CCCW systems accomplished the same goal as did those recommended by the GALL Report. The only parameters recommended for monitoring by EPRI that the applicant did not monitor are those not used or applicable at MNGP.

On the basis of the above review and a review of MNGP operating experience for AMP B2.1.13, the staff found this exception acceptable.

Exception 3: The GALL Report recommends the following for the Parameters Monitored or Inspected program element associated with the exception taken:

> The aging management program (AMP) monitors the effects of corrosion by surveillance testing and inspection in accordance with standards in EPRI TR-107396 to evaluate system and component performance. For pumps, the parameters monitored include flow and discharge and suction pressures. For heat exchangers, the parameters monitored include flow, inlet and outlet temperatures, and differential pressure.

In the LRA, the applicant stated that some of the heat exchanger and pump performance parameters recommended by the GALL Report are not monitored for specific pumps or smaller coolers serviced by the closed-cooling water systems. Some of these components are within the scope of license renewal only for pressure boundary considerations. Chemical control and established performance monitoring techniques based on plant experience have been adequate to detect changes in system performance due to cracking or corrosion.

The staff reviewed selected inspection and monitoring procedures, then compared the required heat exchanger and pump performance parameters against those recommended by the GALL Report. The staff noted the following exceptions to the GALL Report recommendations and the applicant's actions in lieu of those recommendations.

The applicant stated that, as an exception to the GALL Report, inlet reactor building closed cooling water (RBC) heat exchanger temperature is not monitored; however, in addition to the recommendations of the GALL Report, the outlet RBC temperature and both inlet and outlet raw water side temperatures are measured. After an evaluation, the staff found that the additional information that the applicant had gathered is an adequate substitute for the information recommended by the GALL Report, because it verifies that no aging effects reduce heat transfer. The staff reviewed the applicant's additional information and found it acceptable.

The applicant stated that, as an exception to the GALL Report, the RHR and REC pump seal coolers pressure is not monitored; however, flow through these pump seal coolers is monitored, as are RBC surge tank level, various temperatures and flows, and radionuclide levels, all of which alarm when values go out of range. These parameters indicate pressure integrity failures within this closed loop system. Reduced heat transfer performance from temperature monitoring results also can indicate internal corrosion. Additionally, the staff noted that the applicant performed UT measurements of pipe wall thickness to determine the extent of corrosion on select portions of RBC system piping, including piping connected to the REC system pump seal coolers inside the drywell, which confirmed the effectiveness of water chemistry. However, the staff found no direct inspection confirming chemistry effectiveness in mitigating corrosion effects on the RBC system portion connected to the RHR system pump seal coolers or CRD system pump coolers. The staff observed that as an enhancement, a one-time inspection will monitor the effects of corrosion of the RHR system and CRD system pump coolers and nearby connected piping. The staff found that the additional information that the applicant had gathered adequately substituted for information recommended by the GALL Report, because the parameters monitored will ensure that the pressure boundary intended function will continue through the period of extended operation. The staff reviewed the applicant's additional information and found it acceptable.

The applicant stated that, as an exception to the GALL Report, the emergency diesel generator (EDG) jacket water pump suction and discharge pressures and flow are not measured; however, water temperature, closed coolant level, lube oil pressure, and lube oil temperature are monitored quarterly as part of EDG operability tests. As part of the 12-year preventive maintenance (PM) requirements for the EDGs, the jacket water pumps are replaced, the jacket water header of the lube oil cooler is visually inspected, and the jacket water system is inspected for any evidence of leakage from piping or joints (a leak detector dye is used in the coolant). The staff found that the additional information the applicant had gathered adequately substituted for information recommended by the GALL Report, because the parameters monitored will identify aging effects that may impact the intended function of the EDG. The staff reviewed the applicant's additional information and found it acceptable.

The applicant stated that, as an exception to the GALL Report, differential pressure across the EDG coolant heat exchangers is not monitored; however, heat exchanger performance is tested periodically by gathering temperature and flow results. Eddy current testing of the heat exchanger tubes is also periodic. The staff found that the additional information that the applicant had gathered adequately substituted for information recommended by the GALL Report, because it identifies aging effects reducing heat transfer. The staff reviewed the applicant's additional information and found it acceptable.

The applicant stated that, as an exception to the GALL Report, it does not perform heating and ventilation (HTV) system and component performance monitoring. The system contains no heat exchangers, but does contain a number of heating coils for heating to various plant locations. The scope of license renewal includes the piping system and heater coils for pressure integrity only. Some of the heating coils are visually inspected annually for leaks. After an evaluation, the staff found that the additional information that the applicant had gathered adequately substituted for information recommended by the GALL Report, because it will verify that the pressure integrity intended function will continue through the period of extended operation. The staff reviewed the applicant's additional information and found it acceptable.

On the basis of the above review and of a review of operating experience for AMP B2.1.13, the staff found this exception acceptable.

Exception 4: The GALL Report recommends the following for the Acceptance Criteria program element associated with the exception taken:

> Corrosion inhibitor concentrations are maintained within the limits specified in the EPRI water chemistry guidelines for CCCW. System and component performance test results are evaluated in accordance with the guidelines of EPRI TR-107396. Acceptance criteria and tolerances are also based on system design parameters and functions.

In the LRA, the applicant stated that some of the acceptance criteria (ranges) for monitored chemistry parameters based on vendor recommendations and plant operating experience are not identical to the typical ranges specified by EPRI TR-1007820 or EPRI TR-107396. The ranges based on plant operating experience have been sufficient to manage aging effects.

The staff observed that both EPRI TR-107396 and EPRI TR-1007820 specify normal operating ranges for chemical control parameters. They also specify diagnostic parameters, but do not include action levels and ranges, as these parameters are used for trending. Specifically, with regard to the four CCCW systems, the chemical control parameter ranges recommended by EPRI, and hence by the GALL Report, and the corresponding ranges used at MNGP are as follows:

(1) The following applies to the chromate-based RBC system, which also serves the RHR, REC, and CRD coolers:

   a. Chromate—Chromate is monitored to a range of 500 to 1800 parts per million (ppm), not 150 to 300 ppm as recommended by the GALL Report and EPRI. As noted in EPRI TR-107396 and EPRI TR-1007820, this may have a detrimental impact on pump seal integrity. The RBC pump seals are consumables. The applicant installed a new design seal replaced on a 2-year frequency and has monitored for but not detected any impact to system pressure boundary integrity.

   b. pH—pH is monitored to a more restrictive range of 9.0 to 9.7 versus the EPRI TR-107396 range of 8.5 to 10.5 and the EPRI TR-1007820 range of 8.0 to 11.0.

   c. Chloride—Chloride is not monitored in the RBC system. Chloride is monitored in the makeup demineralized water source, which provides makeup to the RBC system. Chloride limits for demineralized water have a limit of 10 parts per billion (ppb), which is substantially lower than the limit of 10 ppm established by both EPRI reports.

(2) The following applies to the cooling loops of the EDG system (DGN):

a. Nitrite—The chemical range for nitrite is identical to that in EPRI TR-107396 (500 to 1000 ppm) and more restrictive than that in EPRI TR-1007820 (50 to 1500 ppm).

b. pH—The range for pH is 9.0 to 10.7, which is more restrictive than the 8.5 to 11.0 range in EPRI TR-1007820 and close to the 8.5 to 10.5 range specified in EPRI TR-107396.

c. Tolytriazole—The specified range for tolytriazole is 10 to 40 ppm, as opposed to the 5 to 30 ppm range recommended in EPRI TR-107396, and more restrictive than the 5 to 100 ppm range recommended in EPRI TR-1007820. EPRI TR-107396 identified no adverse impacts for slightly higher tolytriazole ranges.

d. Chloride—Chloride is not monitored in the cooling loops of the DGN. Chloride is monitored in the makeup demineralized water source, which provides makeup to the cooling loops. Chloride limits for demineralized water have a limit of 10 ppb, which is substantially lower than the limit of 10 ppm established by the EPRI reports.

(3) The following applies to the piping and heating coils of the HTV system:

a. EPRI TR-107396 and EPRI TR-1007820 do not specify chemical ranges for the piping and heating coils of the HTV system, so they are monitored in accordance with vendor recommendations and plant experience. These include conductivity, pH, phosphate, sulfites, and total gamma activity and are specified by plant procedure.

(4) The following applies to the closed cooling loop used on the #14 air compressor of the instrument and service air (AIR) system:

a. Glycol percent volume—Both EPRI TR-107396 and EPRI TR-1007820 recommend that glycol percent volume remain above 30 percent to avoid becoming a nutrient for microbiological growth. Further, EPRI TR-1007820 recommends that the level remain below 60 percent. The applicant maintains a concentration of about 50 percent, which is within the range specified by the EPRI reports.

b. pH—MNGP procedures do not provide a specific range for pH; however, procedures require routine sampling and measurement of pH, and pH is maintained within the range specified by EPRI TR-1007820 of 7.5 to 11.0.

The staff reviewed the operating ranges of each of the above 10 chemical control parameters and noted that eight were either equivalent to or more conservative than the range recommended by the EPRI technical reports. One, the chromate, had a higher range, but the applicant took effective action to mitigate the effects of that higher range. The last was in accordance with vendor recommendations and plant operating experience, as the GALL Report provides no recommendation.

On the basis of the above review and a review of MNGP operating experience for AMP B2.1.13, the staff found this exception acceptable.

In the LRA, the applicant stated that the following enhancement will make this AMP consistent with the recommendation in the GALL Report.

Enhancement: The GALL Report recommends the following for the Parameters Monitored or Inspected program element associated with the enhancement made:

> The aging management program (AMP) monitors the effects of corrosion by surveillance testing and inspection in accordance with standards in EPRI TR-107396 to evaluate system and component performance. For pumps, the parameters monitored include flow and discharge and suction pressures. For heat exchangers, the parameters monitored include flow, inlet and outlet temperatures, and differential pressure.

In the LRA, the applicant stated that a one-time inspection will monitor the effects of corrosion on select portions of CCCW systems that perform a pressure-integrity intended function.

The staff reviewed the applicant's proposed enhancement and determined that augmenting the CCCW systems with a one-time inspection to monitor the effects of corrosion on select portions of CCCW systems that perform a pressure-integrity intended function will provide additional assurance that aging effects are identified before component failures, consistent with GALL AMP XI.M21. On the basis of its review, the staff found this enhancement acceptable, as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of AMP B2.1.13, "Closed-Cycle Cooling Water System Program," that the applicant claimed are consistent with GALL AMP XI.M21 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions and enhancement as described above.

Operating Experience. In LRA Section B2.1.13, the applicant stated that, for the Closed-Cycle Cooling Water System Program, it initiates CRs/ARs when it finds that water chemistry is out of specification or equipment performance does not meet standards. The time duration of these conditions is typically short and no evidence of detrimental equipment impacts was found. The applicant did not identify any examples of CCCW system functional failures due to corrosion, SCC, or heat transfer degradation due to fouling resulting from inadequate chemistry control. Steam leaks have occurred in various portions of the piping and heating coils of the HTV system (steam traps, temperature control valve packing/gaskets, heating coils, and fittings). These leaks have been isolated and corrected, were typically minor in nature, did not impact the operation of nearby safety equipment, and were not linked to inadequate chemistry or corrosion as the cause of the leak. Procedural requirements for chemistry limits are established based on EPRI and industry standards and routinely monitored. The applicant entered a CR into the site CAP because a liquid penetrant examination showed a pin-hole leak on the top side of a sampling line at the tubing end of a tubing-to-insert fillet weld (sampling line connected on top of an RBC heat exchanger). Inadequate original welding of the connection was determined to be the cause of the leak. Adjacent and external surfaces did not show pitting or other signs of distress, suggesting this was a localized effect. The applicant removed and replaced the affected section of stainless steel tubing.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's CCCW System program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.13, the applicant provided the USAR supplement for the CCCW System Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant added a commitment to USAR Section A2.1.13, documented as commitment 23 in Table A.5, that before the period of extended operation, it will conduct a one-time inspection to monitor the effects of corrosion on select portions of CCCW systems performing a pressure-integrity intended function.

Conclusion. On the basis of its review and audit of the applicant's CCCW System Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff also reviewed the enhancement and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 Compressed Air Monitoring Program

Summary of Technical Information in the Application. In LRA Section B2.1.14, the applicant described the Compressed Air Monitoring Program, stating that this existing program is consistent, with exceptions and enhancements, with GALL AMP XI.M24, "Compressed Air Monitoring." The MNGP Compressed Air Monitoring Program consists of inspection, monitoring, and testing of the AIR system to provide reasonable assurance that they will perform their intended function for the duration of extended operation.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and enhancements and the associated justifications to determine whether the AMP, with the exceptions and enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M24.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M24 in the GALL Report.

Exception 1: The GALL Report recommends the following for the Parameters Monitored or Inspected program element associated with the exception taken:

> In-service inspection (ISI) and testing is performed to verify proper air quality and confirm that maintenance practices, emergency procedures, and training are adequate to ensure that the intended function of the air system is maintained.

In the LRA, the applicant stated that it does not perform ISI and inservice testing to verify proper air quality or confirm that maintenance practices, emergency procedures, and training are adequate to ensure that the air system intended function is maintained. This is not an ISI or inservice testing function or activity. Staff engineering personnel verify air quality through semiannual testing in accordance with procedures based on GL 88-14, "Instrument Air Supply System Problems Affecting Safety Equipment," dated August 8, 1988; American National Standards Institute (ANSI)/Instrument Society of America (ISA) S7.3, "Quality Standard for Instrument Air;" ANSI Z86.1-1973, "Commodity Specification for Air and Drager Operating Instruction;" and EPRI TR-103595, "Report of Instrument Air Working Group." Station administrative and training procedures control maintenance practices, emergency procedures, and training.

On the basis of its review of NRC, EPRI, and other industry guidelines and standards, the staff determined that the applicant's inspection and testing verify proper air quality and confirm that maintenance practices, emergency procedures, and training are adequate to ensure that the intended function of the compressed air monitoring systems is maintained. Procedures and programs at MNGP implement Compressed Air Monitoring Program activities recommended by the GALL Report. The MNGP audit and review report details the staff's review. On the basis of a review of the above exception and of operating experience for the Compressed Air Monitoring Program, the staff found this exception acceptable.

Exception 2: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the exception taken:

> Guidelines in EPRI NP-7079, EPRI TR-108147, and ASME OM-S/G-1998, Part 17, ensure timely detection of degradation of the compressed air system function. Degradation of the piping and any equipment would become evident by observation of excessive corrosion, by the discovery of unacceptable leakage rates, and by failure of the system or any item of equipment to meet specified performance limits.

In the LRA, the applicant stated that its program is based on the guidance provided in ANSI/ISA-S7.3-1975, ANSI/ISA-Z86.1-1973, EPRI TR-103595, and GL 88-14 augmented by previous NRC IN 81-38, "Potentially Significant Equipment Failures Resulting for Contamination of Air-Operated Systems," dated December 17, 1981; IN 87-28, "Air System Problems at U.S.

Light-Water Reactors," dated June 22, 1987; IN 87-28 Supplement 1, and by the INPO Significant Operating Event Report (INPO SOER) 88-01. The applicant takes exception to ANSI/ISA-S7.0.01-1996 because it uses ANSI/ISA-S7.3-1975 instead. The applicant takes exception to ASME OM-S/G-1998 Part 17 as specified in GALL AMP XI.M24.

The staff observed that, in lieu of the EPRI NP-7079 guidelines recommended by the GALL Report to detect degradation of compressed air system function, the applicant developed procedures and instructions based on GL 88-14, ANSI/ISA S7.3-1975, ANSI/ISA Z86.1-1973, EPRI TR-103595, INPO SOER 88-01 augmented by IN 81-38, and IN 87-28 with Supplement 1. The staff reviewed and compared ANSI/ISA-S7.3-1975 with ANSI/ISAS7.0.01-1996 and found ANSI/ISA-S7.3-1975 acceptable for use as its criteria are more conservative than recommended by ANSI/ISA-S7.0.01-1996.

During the audit, the staff asked that the applicant clarify its reason for taking exception to ASME OM-S/G-1998, Part 17, which provides guidance for performance testing of instrument air systems in light-water reactor power plants. The applicant responded that the scope of components included in the compressed air monitoring activities includes distribution piping, valves, accumulators for air-operated SR valves, and the containment isolation valves of the instrument air system. The applicant stated that the instrument air system compressors, receivers, filters, and dryers are not within the scope of license renewal. The applicant also stated that its Compressed Air Monitoring Program will adequately manage aging for those instrument air system components within the scope of license renewal. The staff reviewed several procedures and instructions to determine their adequacy and completeness, their frequencies, and their results, including a sampling from the applicant's CAP, and concluded that the applicant is able to ensure timely detection of degradation of the compressed air system function, as shown by its ability to detect corrosion or high leak rates or the failure of any component to meet its performance limits. The staff found the applicant's response acceptable.

On the basis of a review of the above exception and of a review of operating experience for the Compressed Air Monitoring Program, the staff found this exception acceptable.

In the LRA, the applicant stated that the following enhancements will make this AMP consistent with the recommendation in the GALL Report.

Enhancement 1: The GALL Report recommends the following for the Scope of Program program element associated with the enhancement made:

> The program manages the effects of corrosion and the presence of unacceptable levels of contaminants on the intended function of the compressed air system. The AMP includes frequent leak testing of valves, piping, and other system components, especially those made of carbon steel, and a preventive maintenance program to check air quality at several locations in the system.

In the LRA, the applicant stated that it will revise the Compressed Air Monitoring Program procedures to include corrective action requirements if water vapor, oil content, or particulate acceptance limits are not met. In addition, it will clarify the acceptance criteria for oil content testing and provide the acceptance limit bases for water vapor, oil content, and particulate tests.

During the audit, the staff asked that the applicant clarify the above enhancement. The applicant responded that, although it regarded the guidance identified in Exception 2 as conservative compared to the guidance recommended by the GALL Report, it wanted to apply further conservatism in the event that acceptance criteria were not met in any area. The acceptance criteria of the compressed air monitoring systems procedures are evaluated under the CAP. The staff reviewed the enhancement and found this potential augmentation of the acceptance criteria of the compressed air monitoring systems procedures consistent with the recommendations of the GALL Report as it provides additional assurance that aging effects are identified before compressed air monitoring system component failure. Therefore, the staff found this enhancement acceptable.

On the basis of a review of the above enhancement and a review of operating experience for the Compressed Air Monitoring Program, the staff found the enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 2: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the enhancement made:

> Guidelines in EPRI NP-7079, EPRI TR-108147, and ASME OM-S/G-1998, Part 17, ensure timely detection of degradation of the compressed air system function. Degradation of the piping and any equipment would become evident by observation of excessive corrosion, by the discovery of unacceptable leakage rates, and by failure of the system or any item of equipment to meet specified performance limits.

In the LRA, the applicant stated that it will revise its Compressed Air Monitoring Program to include inspection of air distribution piping based on recommendations of EPRI TR-108147, "Compressor and Instrument Air System Maintenance Guide," issued March 1998.

During the audit, the staff asked that the applicant clarify the above enhancement. The applicant responded that EPRI TR-108147 addressed the subject piping with updated recommendations. The staff reviewed the enhancement and determined that expanding the detection of aging effects by including air distribution piping is consistent with the recommendations of the GALL Report and will provide additional assurance that aging effects are identified before compressed air monitoring component failure.

On the basis of a review of the above enhancement and a review of the operating experience for the Compressed Air Monitoring Program, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of AMP B2.1.14 "Compressed Air Monitoring Program," that the applicant claimed are consistent with GALL AMP XI.M24 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions and enhancements as described above.

Operating Experience. In LRA Section B2.1.14, the applicant explained that it based the Compressed Air Monitoring Program on appropriate NRC requirements and industry guidance, including the MNGP response to NRC GL 88-14. It performs established PM tasks and other inspections on a routine basis. For example, it performed and completed a major PM task in June 2003. Plant staff identified a number of system leaks, notified the system engineer, and initiated and completed repair WOs to fix the leaks. Such PM activities and inspections, system repairs, ongoing monitoring, and review of plant and industry operating experience have been effective in maintaining air system performance. Unavailability targets for this system are well within established goals.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the Compressed Air Monitoring Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.14, the applicant provided the USAR supplement for the Compressed Air Monitoring Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter, dated June 10, 2005, the applicant added commitments to USAR Section A2.1.14, documented as commitments 24 and 25 in Table A.5, that before the period of extended operation, it will (1) revise Compressed Air Monitoring Program procedures to include corrective action requirements if the acceptance limits for water vapor, oil content, or particulate are not met, clarify acceptance criteria for oil content testing, and provide the basis for the acceptance limits for the water vapor, oil content, and particulate tests and (2) revise the Compressed Air Monitoring Program to include inspection of air distribution piping based on the recommendations of EPRI TR-108147.

Conclusion. On the basis of its review and audit of the applicant's Compressed Air Monitoring Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff also reviewed the enhancements and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program

Summary of Technical Information in the Application. In LRA Section B2.1.16, the applicant described the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification

Requirements Used in Instrumentation Circuits Program, stating that this new program is consistent, with exceptions, with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits." This program applies to non-EQ electrical cables used in radiation monitoring and nuclear instrumentation circuits with sensitive, low-level signals that are within scope of license renewal and are installed in adverse localized environments caused by heat, radiation, and moisture in the presence of oxygen. Exposure of electrical cables to adverse localized environments caused by heat or radiation can result in reduced insulation resistance (IR). Reduced IR causes an increase in leakage currents between conductors and from individual conductors to ground. A reduction in IR is a concern for circuits with sensitive, low-level signals such as radiation monitoring and nuclear instrumentation since it may contribute to inaccuracies in the instrument loop.

This AMP uses routine calibration tests performed as part of the plant surveillance test program to identify the potential existence of aging degradation. When an instrumentation loop is found to be out of calibration during routine surveillance testing, troubleshooting is performed on the loop, including the instrumentation cable. In cases in which a calibration or surveillance program does not include the cabling system in the testing circuit, or as an alternative to the review of calibration results described above, the applicant will perform cable system testing. Plant staff will perform a proven cable system test for detecting deterioration of the insulation system (such as IR tests, time domain reflectometry test, or other testing judged to be effective in determining cable insulation condition).

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.E2.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.E2 in the GALL Report.

Exception: The GALL Report identifies the following criteria for the Parameters Monitored or Inspected, Detection of Aging Effects, and Acceptance Criteria program elements associated with the exception taken:

Parameters Monitored/Inspected:

> The parameters monitored are determined from the plant technical specifications and are specific to the instrumentation loop being calibrated, as documented in the surveillance testing procedure.

Detection of Aging Effects:

> Calibration provides sufficient indication of the need for corrective actions by monitoring key parameters and providing trending data based on acceptance criteria related to instrumentation loop performance. The normal calibration frequency specified in the plant technical specifications provides reasonable assurance that severe aging degradation will be detected prior to loss of the cable intended function. The first tests for license renewal are to be completed before the period of extended operation.

Acceptance Criteria:

> Calibration readings are to be within the loop-specific acceptance criteria, as set out in the plant technical specifications surveillance test procedures.

In the LRA, the applicant stated that the surveillance tests required by its TS either do not include all cables within the scope of license renewal or do not include the cable as part of the calibration procedure. The program will periodically test the cable insulation condition for those cables not already tested by TS requirements.

The applicant further stated that for those cables not tested as part of TS surveillance procedures, the program will periodically test the cable insulation. The staff reviewed the applicant's exception and found it acceptable because Interim Staff Guidance (ISG)-15 states that either (1) calibration results or findings of surveillance testing or (2) direct testing of cable systems can be used to detect aging degradation of electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits.

On the basis of its review of the Electrical Cables Not Subject to 10 CFR 50.49 EQ Requirements Used in Instrumentation Circuits Program and in conjunction with the operating experience, the staff found this exception acceptable.

The staff reviewed those portions of the AMP B2.1.16, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program," that the applicant claimed are consistent with GALL AMP XI.E2 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exception as described above.

Operating Experience. In LRA Section B2.1.16, the applicant stated that the Electrical Cables Not Subject to 10 CFR 50.49 EQ Requirements Used in Instrumentation Circuits Program is a new program and as such has no plant-specific operating experience; however, as noted in the GALL Report, industry operating experience shows that exposure of electrical cables to adverse local environments caused by heat or radiation result in reduced IR. Reduced IR causes an increase in leakage currents between conductors and from individual conductors to ground. A reduction in IR is a concern for circuits with sensitive, low-level signals like radiation monitoring and nuclear instrumentation circuits as it may contribute to signal inaccuracies.

During the audit and review, the staff asked the applicant how it captures operating experience. The applicant stated that its CAP identifies, tracks, and trends site operating experience with all site components. The applicant documents any site component identified as degraded, failed, or potentially unable to fulfill intended functions in the site CAP database. Plant engineering staff then evaluate these CAPs for the extent of the condition and take appropriate followup actions. Plant engineering staff also trend related CAPs to identify generic issues. They address trended site issues in program health reports and present them to site management on a scheduled basis. The CAP also addresses 10 CFR 54.21 issues and external operating events from the NRC, INPO, LIS, and the applicant's fleet. The staff reviewed the applicant's response and found it acceptable.

The staff recognizes that the CAP, which captures internal and external plant operating experience issues, ensures review and incorporation of operating experience as objective evidence to support the conclusion that aging effects are adequately managed.

USAR Supplement. In LRA Section A2.1.16, the applicant provided the USAR supplement for the Electrical Cables Not Subject to 10 CFR 50.49 EQ Requirements Used in Instrumentation Circuits Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter, dated June 10, 2005, the applicant included a commitment to USAR Section A2.1.16, documented as commitment 27 in Table A.5, which states the following:

> Prior to the period of extended operation, the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program will be implemented as a new program. With exceptions, it will be consistent with the recommendations of NUREG-1801 Chapter XI Program XI.E2.

Conclusion. On the basis of its review and audit of the applicant's Electrical Cables Not Subject to 10 CFR 50.49 EQ Requirements Used in Instrumentation Circuits Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.15 Fire Protection Program

Summary of Technical Information in the Application. In LRA Section B2.1.17, the applicant described the Fire Protection Program, stating that this existing program is consistent, with exception and enhancement, with GALL AMP XI.M26, "Fire Protection." For license renewal purposes, the MNGP Fire Protection Program includes a fire barrier inspection program, a diesel-driven fire pump inspection program, and a halon fire suppression system inspection. The fire barrier inspection program requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of associated fire rated doors to ensure that their operability is maintained. The diesel-driven fire pump inspection program requires that the pump be periodically tested and the diesel engine inspected to ensure that the fuel supply line can perform the intended function. The halon fire suppression system inspection included periodic inspection and testing of the cable spreading room halon fire suppression system.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exception and enhancement and the associated justifications to determine whether the AMP, with the exception and enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M26.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.M26 in the GALL Report.

Exception: The GALL Report recommends the following for the Parameters Monitored and Inspected program element associated with the exception taken:

> Periodic visual inspection and function test at least once every six months examines the signs of degradation of the halon/carbon dioxide fire suppression system. The suppression agent charge pressure is monitored in the test. Material conditions that may affect the performance of the system, such as corrosion, mechanical damage, or damage to dampers, are observed during these tests. Inspections performed at least once every month to verify that the extinguishing agent supply valves are open and the system is in automatic mode.

In the LRA, the applicant stated that it conducts periodic visual inspections and function tests of halon systems at least once every 6 months. The cable spreading room halon system is functionally tested and visually inspected every 18 months instead of every 6 months as recommended in GALL AMP XI.M26.

In LRA Section B2.1.17 and the associated basis document, the applicant provided its justification conducting these activities every 18 months instead of every 6. According to the applicant, the surveillance interval specified in the Operations Manual is part of the NRC-approved Fire Protection Program, and thus forms an element of the plant's CLB. In response to the staff interviews, the applicant's personnel provided further information, including the System Health Report—Fire Protection.

The applicant's technical personnel stated that they reviewed industry operating experience, the previous cable spreading room halon system surveillance test results, and plant-specific operating experience for this subsystem. This review of operating experience revealed no age-related degradation, and thus the applicant stated that the 18-month frequency is acceptable.

The staff interviewed the applicant about parameters monitored or inspected as part of fire protection (FP) relative to the guidelines for the frequency of inspections. The applicant stated that the program has specific guidelines for the frequency of inspections requiring, for example, visual inspections of penetration seal fire area boundaries protecting safe-shutdown equipment every 18 months or following repair or maintenance of such penetrations. These inspections cover 10 percent of each type of seal, consistent with GALL Report recommendations. The staff also reviewed other inspection criteria for fire doors, the diesel driven fire pump, and the halon/carbon dioxide systems. Based on the staff's review of industry and plant-specific operating experience, performance of surveillance tests, and the FP system health reports, the exception of the inspection frequency of 18 months instead of 6 months is acceptable, because the incubation period for the effect is long, and the different inspection frequencies did not result in any differences in finding aging effects.

In the LRA, the applicant stated that the following enhancement will make this AMP consistent with the recommendation in the GALL Report.

Enhancement: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the enhancement made:

> ...If any sign of degradation is detected within that 10 percent, the scope of the inspection and frequency is expanded to ensure timely detection of increased hardness and shrinkage of the penetration seal before the loss of the component intended function. Visual inspection (VT-1 or equivalent) of the fire barrier walls, ceilings, and floors performed in walkdown at least once every refueling outage ensures timely detection for concrete cracking, spalling, and loss of material. Visual inspection (VT-3 or equivalent) detects any sign of degradation of the fire door such as wear and missing parts...

In the LRA, the applicant stated that it will revise its existing Fire Protection Program cable spreading room halon visual inspection procedure to include inspection for any signs of degradation such as corrosion and mechanical damage. This visual inspection will manage aging for external surfaces of the cable spreading room halon fire suppression system. The applicant will revise the Fire Protection Program plan document to include qualification criteria for individuals visually inspecting penetration seals, fire barriers, and fire doors. The qualification criteria will be in accordance with VT-1 or equivalent and VT-3 or equivalent, as applicable.

The staff's evaluation and review of plant-specific operating experience found the enhancement to the Fire Protection Program to detect signs of aging by including qualification criteria for inspection personnel and VT-1 and VT-3 inspections of the penetration seals, fire barriers, and fire doors to be acceptable and consistent with the GALL Report for this AMP, which will manage aging during the period of extended operation.

On the basis of the staff evaluation of the above enhancement and review of the operating experience for the Fire Protection Program, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of AMP B2.1.17, "Fire Protection Program," that the applicant claimed are consistent with GALL AMP XI.M26 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exception and enhancement as described above.

Operating Experience. In LRA Section B2.1.17, the applicant explained that, through the use of established plant surveillance and procedures, its staff inspects barriers and other features on a periodic basis. Recent assessments have noted that the overall material condition is good. For example, the December 2000 self-assessment using industry guidance (NEI Self- Assessment Guide 99-05) concluded that the observed seals and fireproofing appeared to be in good condition. The applicant documents and resolves problems through the site CAP. It entered prior issues with program performance noted during the NRC 2002 inspection into the site CAP database for assessment and resolution. MNGP implemented a number of extensive corrective actions to improve program performance, including improved identification and resolution of deficiencies. It performed an extensive self-assessment in March 2004 to evaluate progress and program compliance. Though some areas of vulnerability were noted for correction and continued focus, a number of program strengths were identified and the assessment concluded that the MNGP program is consistent with corporate directive requirements and had made significant progress in addressing the findings from the 2002 inspection.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Fire Protection Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.17, the applicant provided the USAR supplement for the Fire Protection Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter, dated June 10, 2005, the applicant included the following two commitments to Section A2.1.17, documented as commitments 28 and 29 in Table A.5, that it will implement before the period of extended operation:

(1) The applicant will revise the Fire Protection Program to include a visual inspection of the halon fire suppression system to detect any signs of degradation, such as corrosion, or mechanical damage. This visual inspection will manage aging for external surfaces of the halon fire suppression system.

(2) The applicant will revise the Fire Protection Program to include qualification criteria for individuals visually inspecting penetration seals, fire barriers, and fire doors. The qualification criteria will be in accordance with VT-1, VT-3, or equivalent as applicable.

Conclusion. On the basis of its review and audit of the applicant's Fire Protection Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exception and the associated justifications and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff also reviewed the enhancement and confirmed that its implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 Fire Water System Program

Summary of Technical Information in the Application. In LRA Section B2.1.18, the applicant described the Fire Water System Program, stating that this existing program is consistent, with enhancement, with GALL AMP XI.M27, "Fire Water System." The Fire Water System Program relies on testing of water-based FP system piping and components in accordance with applicable National Fire Protection Association (NFPA) recommendations. In addition, the applicant will modify this program to include (1) portions of the FP sprinkler system that are subjected to full flow tests before the period of extended operation and (2) portions of the FP system exposed to water that are internally visually inspected. To ensure that the aging mechanisms of corrosion and biofouling/fouling are properly being managed in the fire water system, the applicant conducts periodic full flow flush tests and system performance tests. The system is also normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the enhancement and the associated justifications to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M27.

In the LRA, the applicant stated that the following enhancement will make this AMP consistent with the recommendation in the GALL Report.

Enhancement: The GALL Report recommends the following for the Program Description program element associated with the enhancement made:

> ...In addition, a sample of sprinkler heads is to be inspected by using the guidance of NFPA 25, Section 2.3.3.1. This NFPA section states that 'where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing.' It also contains guidance to perform this sampling every 10 years after the initial field service testing...

In the LRA, the applicant stated it will enhance the Fire Water System Program by implementing procedures that will be revised to include the extrapolation of inspection results to below-grade fire water piping with conditions similar to those within the above-grade fire water piping. It will inspect and test the Fire Water System Program sprinkler heads or replace them before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation to ensure that signs of degradation, such as corrosion, are detected promptly. Enhancements are scheduled for completion before the period of extended operation.

The staff found in its evaluation and review of plant-specific operating experience that the enhancement to the Fire Water System Program to detect signs of aging by wall thickness evaluations on above-grade piping, inspections before the period of extended operation, and extrapolations of above-ground conditions to below-ground piping for further inspections is acceptable and consistent with GALL Report recommendations relying on NFPA codes and with GALL AMP XI.M27.

On the basis of its review of the above enhancement and review of operating experience for the MNGP Fire Water System Program, the staff found this enhancement acceptable as such changes to the applicant's program provides assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of AMP B2.1.18, "Fire Water System Program," that the applicant claimed are consistent with GALL AMP XI.M27 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the enhancement as described above.

Operating Experience. In LRA Section B2.1.18, the applicant explained that through the use of established plant surveillances and procedures, the fire water system is periodically inspected, tested, flushed, and maintained. It evaluates industry and plant experience for system performance impacts. The applicant documents performance issues and evaluates them through the site CAP. System availability has been good; only six cases of system impairment for more than 48 hours, in order to perform required maintenance, have occurred since October 1996. System unavailability is within Maintenance Rule program goals. The applicant also provided an example of program activities. It conducted a FP system walkdown that reported that the system was in good condition but identified two areas of concern. First, the FP system engineer trended greater than minimal packing leakage on the screenwash/fire pump. The applicant will perform repacking when necessary to resolve this issue. The second concern was with a seal leak on the FP jockey pump. Plant staff replaced the mechanical seal under the work control process.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Fire Water System Program will adequately manage the aging effects identified in LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.18, the applicant provided the USAR supplement for the Fire Water System Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant added the following three commitments to LRA Section A2.1.18, documented as commitments 30, 31, and 32 in Table A.5, which the applicant will perform before the period of extended operation:

(1) The applicant will revise the implementing procedures for the Fire Water System Program to include extrapolation of inspection results to below-grade fire water piping with conditions similar to those within above-grade fire water piping.

(2) Sprinkler heads will be inspected and tested in accordance with NFPA requirements or replaced before the end of their 50-year service life and at 10-year intervals thereafter during the extended period of operation to ensure that degradation, such as corrosion, is detected promptly. Procedures to be used for aging management activities (AMAs) of the Fire Water System Program will be verified and testing will be performed in accordance with applicable NFPA codes and standards. The applicant will revise relevant procedures as appropriate.

(3) The applicant will verify that the procedures to be used for AMAs of the fire water system apply testing in accordance with the applicable NFPA codes and standards. It will revise the relevant procedures as appropriate.

Conclusion. On the basis of its review and audit of the applicant's Fire Water System Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancement and confirmed that its implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.17 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. In LRA Section B2.1.20, the applicant described the Fuel Oil Chemistry Program, stating that this existing program is consistent, with exceptions and enhancements, with GALL AMP XI.M30, "Fuel Oil Chemistry." The Fuel Oil Chemistry Program mitigates and manages aging effects on the internal surfaces of diesel fuel oil storage tanks and associated components in systems that contain diesel fuel oil. The program includes (1) surveillance and monitoring procedures for maintaining diesel fuel oil quality by controlling contaminants in accordance with applicable ASTM standards, (2) periodic draining of water from diesel fuel oil tanks, if water is present, (3) periodic or conditional visual inspection of internal surfaces or wall thickness measurements (e.g., by UT) from external surfaces of diesel fuel oil tanks, and (4) one-time inspections of a representative sample of components in systems that contain diesel fuel oil.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and enhancements and the associated justifications to determine whether the AMP, with the exceptions and enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M30.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M30 in the GALL Report.

Exception 1: The GALL Report recommends the following for the Preventive Actions program element associated with the exception taken:

> The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms.

In the LRA, the applicant stated that its Fuel Oil Chemistry Program does not currently use biocides, stabilizers, and corrosion inhibitors.

The staff found this exception acceptable based on its review of various documents on site, including a comparison of ASTM standards with those recommended in the GALL Report, historical oil analyses, the PBD, and discussions with plant personnel. The review of the historical oil analyses and discussions with plant personnel showed that there had been no biological breakdown of fuel oil and that the oil purchased to ASTM D 975 requirements has remained stable and free of corrosion during storage and use. On the basis of the above review and review of plant-specific operating experience for the Fuel Oil Chemistry Program, the staff found this exception acceptable.

Exception 2: The GALL Report recommends the following for the Parameters Monitored or Inspected program element associated with the exception taken:

> The AMP monitors fuel oil quality and the levels of water and microbiological organisms in the fuel oil, which cause the loss of material of the tank internal surfaces. The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for determination of water and sediment contamination in diesel fuel. For determination of particulates, *modified* ASTM D 2276, Method A, is used. The modification consists of using a filter with a pore size of 3.0 μm, instead of 0.8 μm. These are the principal parameters relevant to tank structural integrity.

In the LRA, the applicant stated that it does not use ASTM D 2709 or ASTM D 2276, but ASTM D 6217, "Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration," as a laboratory test to sample diesel fuel oil for suspended particulates. This standard applies to the grade of diesel fuel oil and also uses the more conservative 0.8 micrometer (μm) filter pore size instead of the recommended 3.0 μm.

The staff found this exception acceptable based on its review of various documents on site, including a comparison of ASTM standards with those recommended in the GALL Report. Review of ASTM D 6217 showed that this laboratory analysis of the fuel oil specifically applies to the grade of oil used, and the applicant uses a more conservative filter pore size than that recommended by the GALL Report. On the basis of the above review and its review of plant-specific operating experience for the Fuel Oil Chemistry Program, the staff found this exception acceptable.

Exception 3: The GALL Report recommends the following for the Acceptance Criteria program element associated with the exception taken:

> The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for guidance on the determination of water and sediment contamination in diesel fuel. Modified ASTM D 2276, Method A is used for determination of particulates. The modification consists of using a filter with a pore size of 3.0 μm, instead of 0.8 μm.

In the LRA, the applicant stated that it does not use ASTM D 2709 or ASTM D 2276, but uses ASTM D 6217 as a laboratory test to sample diesel fuel oil for suspended particulates. This standard applies to the grade of diesel fuel oil used at MNGP and uses the more conservative 0.8 μm filter pore size instead of the recommended 3.0 μm.

The staff found this exception acceptable based on its review of various documents on site, including a comparison of ASTM standards with those recommended in the GALL Report. Review of ASTM D 1796 showed that it specifically applies to the type of diesel fuel used and contains the necessary and sufficient requirements for sampling for sediment and water. Additionally, a review of ASTM D 6217 showed that it contains test parameters, performed by an offsite laboratory, equivalent to ASTM D 2276 recommended in the GALL Report. On the basis of the above review and its review of plant-specific operating experience for the Fuel Oil Chemistry Program, the staff found this exception acceptable.

In the LRA, the applicant stated that the following enhancements will make this AMP consistent with the recommendation in the GALL Report.

Enhancement 1: The GALL Report recommends the following for the Scope of Program program element associated with the enhancement made:

> The program is focused on managing the conditions that cause general, pitting, and microbiologically influenced corrosion (MIC) of the diesel fuel tank internal surfaces. The program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and microbiological organisms.

In the LRA, the applicant stated that it will revise the procedures for the diesel fuel oil system to include requirements to check for general, pitting, crevice, and galvanic corrosion, MIC, and cracking.

The staff review of various documents on site, including a comparison of ASTM standards with those recommended in the GALL Report, the PBD, and discussions with plant personnel determined that the requirements to check for general, pitting, crevice, and galvanic corrosion, MIC, and cracking will continually verify the effectiveness of the program. On the basis of the above review and its review of plant-specific operating experience for the Fuel Oil Chemistry Program, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 2: The GALL Report recommends the following for the Preventive Actions program element associated with the enhancement made:

> The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms.

In the LRA, the applicant stated that it will revise its Fuel Oil Chemistry Program to require tank *draining, cleaning, and inspection if deemed necessary based on trends indicated by results of* the diesel fuel oil analysis, or if recommended by the system engineer based on equipment operating experience.

The staff review of various documents on site, including a comparison of ASTM standards with those recommended in the GALL Report, the PBD, and discussions with plant personnel determined that these requirements (i.e., to provide tank draining, cleaning, and inspection if deemed necessary based on the trends indicated by the results of the diesel fuel oil analysis or as recommended by the system engineer based on equipment operating experience) will provide a continuing check on the effectiveness of the program. On the basis of the above review and its review of plant-specific operating experience for the Fuel Oil Chemistry Program, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 3: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the enhancement made:

> Degradation of the diesel fuel oil tank cannot occur without exposure of the tank internal surfaces to contaminants in the fuel oil, such as water and microbiological organisms. Compliance with diesel fuel oil standards in item 3, above, and periodic multilevel sampling provide assurance that fuel oil contaminants are below acceptable levels. Internal surfaces of tanks that are drained for cleaning are visually inspected to detect potential degradation. However, corrosion may occur at locations in which contaminants may

accumulate, such as a tank bottom, and an ultrasonic thickness measurement of the tank bottom surface ensures that significant degradation is not occurring.

In the LRA, the applicant stated it will write a procedure or revise existing procedures in the MNGP Fuel Oil Chemistry Program to require periodic inspections of the diesel fuel oil tanks.

The staff review of various documents on site, including a comparison of ASTM standards with those described in the GALL Report, the PBD, and discussions with plant personnel, determined that the requirement to write or revise the Fuel Oil Chemistry Program procedures to require periodic inspections of the diesel fuel oil tanks will be a continuing check on the effectiveness of the program. The addition of periodic tank inspections will make the program consistent with the recommendations of the GALL Report. On the basis of the above review and its review of plant-specific operating experience for the Fuel Oil Chemistry Program, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of the AMP B2.1.20, "Fuel Oil Chemistry Program," that the applicant claimed are consistent with GALL AMP XI.M30 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions and enhancements as described above.

Operating Experience. In LRA Section B2.1.20, the applicant explained that monthly and quarterly diesel fuel oil sampling and trending activities have confirmed the adequacy of the diesel fuel oil supply. Past tank cleanings and inspections have shown that the condition of the tanks has not degraded.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the Fuel Oil Chemistry Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.20, the applicant provided the USAR supplement for the Fuel Oil Chemistry Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant included commitments to LRA Section A2.1.20, documented as commitments 33, 34, and 35 in Table A.5, to perform the following before the period of extended operation:

(1) The applicant will revise its procedures related to the diesel fuel oil system to include requirements to check for general, pitting, crevice, and galvanic corrosion, MIC, and cracking.

(2) The applicant will revise its Fuel Oil Chemistry Program procedures to require tank draining, cleaning, and inspection if deemed necessary based on the trends indicated by the results of the diesel fuel oil analysis, or as recommended by the system engineer based on equipment operating experience.

(3) The applicant will develop or revise procedures for the MNGP Fuel Oil Chemistry Program to require periodic inspections of the diesel fuel oil tanks.

Conclusion. On the basis of its review and audit of the applicant's Fuel Oil Chemistry Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff also reviewed the enhancements and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program

Summary of Technical Information in the Application. In LRA Section B2.1.22, the applicant described the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, stating that this existing program is consistent, with exception and enhancement, with GALL AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems." The Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems Program, which the applicant implements through plant procedures and PM, manages loss of material of structural components for heavy load and fuel handling components within the scope of license renewal. The Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems Program provides for visual and NDE inspections of load-handling components within the scope of license renewal. The applicant also performs functional tests to assure their integrity. The cranes also comply with the Maintenance Rule requirements provided in 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exception and enhancement and the associated justifications to determine whether the AMP, with the exception and enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M23.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.M23 in the GALL Report.

Exception: The GALL Report recommends the following for the Parameters Monitored or Inspected program element associated with the exception taken:

> The program evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes. The number and magnitude of lifts made by the crane are also reviewed.

In the LRA, the applicant stated, except for special lifts made by the turbine building crane, its program does not track the number and size of lifts because administrative controls ensure that only allowable loads are handled, and fatigue failure of structural elements is not expected with the limited number of lifts.

The staff reviewed information on the reactor building crane that notes that it has the design capacity for many more lifts at a higher rated tonnage than are expected to take place over its 60-year life. Additionally, the applicant informed the staff that it also performs inspections and functional checks on the other cranes periodically and before use. The applicant also provided operating experience showing no degradation caused by aging since plant startup. The staff found this exception acceptable based on its review of information that demonstrates the design capabilities of the reactor building crane and the required inspections before the operation of other cranes, and review of operating experience.

In the LRA, the applicant stated that the following enhancement will make this AMP consistent with the recommendation in the GALL Report.

Enhancement: The GALL Report recommends the following for Detection of Aging Effects program element associated with the enhancement made:

> Crane rails and structural components are visually inspected on a routine basis for degradation. Functional tests are also performed to assure their integrity.

The applicant will enhance the program to specify a 5-year inspection frequency for the fuel preparation machines.

The staff review of various documents on site, including a comparison of the GALL Report recommendations with the proposed enhancements, the PBD, and discussions with plant personnel, determined that this requirement, a 5-year inspection frequency for the fuel preparation machines, continually verifies the effectiveness of the program. The 5-year frequency is acceptable as operating experience shows no degradation caused by aging since installation; therefore, any aging mechanisms appear to act slowly. The addition of a specified period for fuel preparation machine inspection ensures that each component is visually inspected routinely for degradation and conforms with the recommendation in the GALL Report.

On the basis of the above review and a review of operating experience for the AMP, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of AMP B2.1.22, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program," that the applicant claimed are consistent with GALL AMP XI.M23 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exception and enhancement as described above.

Operating Experience. In LRA Section B2.1.22, the applicant explained that no incidents of failure of passive components for cranes and special lifting devices because of aging have occurred at MNGP. The inspection activities have detected and managed aging effects in crane and special lifting device components. A magnetic particle inspection of the dryer and steam separator sling found a linear indication, which was repaired before to use. An inspection of the reactor vessel head lifting device noted some minor degradation, which, in accordance with procedure, was repaired and painted.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.22, the applicant provided the USAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant included a commitment to LRA Section A2.1.22, documented as commitment 37 in Table A.5, that before the period of extended operation, the applicant will enhance the Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems Program to specify a 5-year inspection frequency for the fuel preparation machines.

Conclusion. On the basis of its review and audit of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exception and the associated justifications and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff also reviewed the enhancement and confirmed that its implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.19 Plant Chemistry Program

Summary of Technical Information in the Application. In LRA Section B2.1.25, the applicant described the Plant Chemistry Program, stating that this existing program is consistent, with exceptions, with GALL AMP XI.M2, "Water Chemistry." The MNGP Plant Chemistry Program mitigates the aging effects on component surfaces that are exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits based on BWRVIP-130". This document supersedes previous revisions of the BWR water chemistry guidelines, including BWRVIP-29. For low-flow or stagnant portions of a system, a one-time inspection of selected components at susceptible locations provides verification of the effectiveness of the Plant Chemistry Program.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M2.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M2 in the GALL Report.

Exception 1: The GALL Report recommends the following for the Scope of Program element associated with the exception taken:

> The program includes periodic monitoring and control of known detrimental contaminants such as chlorides, fluorides (PWRs only), dissolved oxygen, and sulfate concentrations below the levels known to result in loss of material or crack initiation and growth. Water chemistry control is in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515) for water chemistry in BWRs; EPRI TR-105714, Rev. 3, for primary water chemistry in PWRs; EPRI TR102134, Rev. 3, for secondary water chemistry in PWRs; or later revisions or updates of these reports as approved by the staff.

In the LRA, the applicant stated that the Plant Chemistry Program uses BWRVIP-130, which supersedes previous revisions of the BWR water chemistry guidelines, including BWRVIP-29.

Based on technical analysis, the staff found the provisions of Revision 2 of BWRVIP-29, issued in 2000, acceptable based on updated industry experience. BWRVIP-130 is the current update of the BWR water chemistry guidelines and supersedes BWRVIP-29, Revision 2. BWRVIP-130 is based on updated industry experience with increased emphasis on fuel performance concerns, while retaining the chemistry parameters, action levels, and associated measurement frequencies essentially unchanged.

LRA Section B2.1.25 states that this program has one exception in that the Plant Chemistry Program uses the 2004 revision, not the 1993, 1996, or 2000 revisions, of the EPRI BWR water chemistry guidelines. BWRVIP-130 replaced BWRVIP-29, Revision 2. The applicant stated that the new program incorporates updated industry experience with increased focus on fuel performance, while retaining the chemistry parameters, action levels, and associated measurement frequencies essentially unchanged. The staff interviewed the applicant regarding the relationship of the existing Plant Chemistry Program and the elements of BWRVIP-130 to the 2000 revision of the BWR water chemistry guidelines. The applicant stated that the Plant Chemistry Program has the elements of BWRVIP-29 and incorporates updated guidelines based on industry experience. The staff comparison of the EPRI 2000 revision of the guidelines against the EPRI 2004 revision used by the applicant also shows that the guideline was updated to show industry experience.

The staff determined from the documentation of these chemistry revisions that the adoption of the 2004 revision (BWRVIP-130) resulted in no significant changes to critical program elements, and that the revision includes updates to the technical basis and guidance to reflect additional industry experience with increased focus on fuel performance, while retaining the same chemistry parameters, action levels, and associated measurement frequencies. Therefore, the staff found the exception acceptable.

Exception 2: The GALL Report recommends the following for the Parameters Monitored or Inspected program elements associated with the exception taken:

> *BWR Water Chemistry:* The guidelines in BWRVIP-29 (EPRI TR-103515) for BWR reactor water recommend that the concentration of chlorides, sulfates, and dissolved oxygen are monitored and kept below the recommended levels to mitigate corrosion. The two impurities, chlorides and sulfates, determine the coolant conductivity; dissolved oxygen, hydrogen peroxide, and hydrogen determine electrochemical potential (ECP). The EPRI guidelines recommend that the coolant conductivity and ECP are also monitored and kept below the recommended levels to mitigate SCC and corrosion in BWR plants. The EPRI guidelines in BWRVIP-29 (TR-103515) for BWR feedwater, condensate, and control rod drive water recommends that conductivity, dissolved oxygen level, and concentrations of iron and copper (feedwater only) are monitored and kept below the recommended levels to mitigate SCC. The EPRI guidelines in BWRVIP-29 (TR-103515) also include recommendations for controlling water chemistry in auxiliary systems: torus/pressure suppression chamber, condensate storage tank, and spent fuel pool.

In the LRA, the applicant stated the Plant Chemistry Program does not measure hydrogen peroxide. Instead, plant staff perform site-specific radiolysis modeling. As noted in BWRVIP-130, reliable measurements of hydrogen peroxide are exceptionally difficult to obtain, and concentration can be estimated from radiolysis models.

The staff interviewed the applicant for technical justification for its initial use of reactor vendor models as the basis for hydrogen water chemistry. Since then, EPRI had developed a software program, known as the BWR Vessel and Internals Application, as part of the BWRVIP now used for radiolysis and ECP monitoring for specific regions inside the reactor vessel. Results from this model have been compared to prior reactor vendor models to confirm appropriate application of the software modeling applications. The applicant runs the model at least twice during each operating cycle to account for changes in reactor flux and core flow on model results.

The staff found in its evaluation and review of plant-specific operating experience that the exception to the Plant Chemistry Program to use site-specific radiolysis modeling instead of measuring hydrogen peroxide is acceptable and consistent with the GALL Report because radiolysis models are acceptable for establishing hydrogen injection rates (to reduce oxidants in the RCS, and thus SCC) as established by EPRI guidelines for BWR vessel internals.

On the basis of its review of the above exception and of operating experience for the Plant Chemistry Program, the staff found this exception acceptable.

The staff reviewed those portions of AMP B2.1.25, "Plant Chemistry Program," that the applicant claimed are consistent with GALL AMP XI.M2 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions as described above.

Operating Experience. In LRA Section B2.1.25, the applicant explained that CRs/ARs are initiated when water chemistry is found to be out of specification. Many of these conditions result from equipment or plant transient conditions (e.g., plant startup) that are resolved once the transient condition subsides. The time duration of these conditions is typically short and no evidence of detrimental equipment impacts could be found. Further, no examples of component functional failures due to corrosion, cracking, or heat transfer degradation resulting from inadequate chemistry control were identified. The applicant addressed industry experience related to IGSCC issues by replacing components with less susceptible materials, implementation of hydrogen water chemistry, and improvements in water chemistry standards. It replaced the entire recirculation system piping, a number of safe ends connected to the reactor vessel, the jet pump holddown beam assemblies, and the shroud head bolts with materials less susceptible to IGSCC. No adverse trends in water chemistry control were identified based on a review of various chemistry performance indicators. Established procedural requirements for chemistry limits are based on EPRI and industry standards and routinely monitored by the site. Recent external and internal assessments have identified chemistry trending as a strength and personnel knowledge as good. These conclusions are based on a review of CAP issues on chemistry (and out of specification chemistry limits) from January 1, 1996, through May 1, 2004, recent external and internal Chemistry Department assessment results, system health reports, and chemistry performance indicators and trends.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Plant Chemistry Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.25, the applicant provided the USAR supplement for the Plant Chemistry Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Plant Chemistry Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 Protective Coating Monitoring & Maintenance Program

Summary of Technical Information in the Application. In LRA Section B2.1.27, the applicant described the Protective Coating Monitoring & Maintenance Program, stating that this existing program is consistent, with enhancements, with GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program." The Protective Coating Monitoring and Maintenance Program applies to Service Level 1 protective coatings inside containment to address the concerns of NRC GL 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Cooling Accident because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," dated July 14, 1998. The Protective Coating Monitoring & Maintenance Program prevents the degradation of coatings that could lead to the clogging of Emergency Core Cooling System (ECCS) suppression pool suction strainers. MNGP does not credit the Protective Coating Monitoring and Maintenance Program for the prevention of corrosion of carbon steel components. As outlined in the MNGP response to GL 98-04, the Protective Coating Monitoring and Maintenance Program is a comparable program for monitoring and maintaining protective coatings inside the primary containment and subject to the requirements of ANSI N101.4-1972, to the extent specified in ANSI N18.7-1976 and as modified by RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," issued June 1973.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.S8.

In the LRA, the applicant stated that the following enhancements will make this AMP consistent with the recommendation in the GALL Report.

Enhancement 1: The GALL Report recommends the following for the Scope of Program program element associated with the enhancement made:

> The minimum scope of the program is Service Level 1 coatings, defined in RG 1.54, Rev 1, as follows: "Service Level 1 coatings are used in areas inside the reactor containment where the coating failure could adversely affect the operation of post-accident fluid systems and thereby impair safe shutdown."

In the LRA, the applicant stated that it will update the MNGP Protective Coating Monitoring & Maintenance Program to include inspection of all accessible painted surfaces inside containments.

The staff noted that the GALL Report states that a comparable program for monitoring and maintaining protective coatings inside containments, developed in accordance with RG 1.54, Revision 0, or the ANSI standards (since withdrawn) referenced in RG 1.54, Revision 0, and coatings maintenance programs described in licensee responses to GL 98-04, is also acceptable as an AMP for license renewal. The applicant's program is a "comparable program," as defined above. The staff determined that this enhancement (i.e., requiring an inspection of all accessible painted surfaces inside containment) makes the program consistent with the GALL Report recommendation of Service Level 1 coatings as defined in RG 1.54, Revision 1. On the basis of the above review and its review of operating experience for the Protective Coating Monitoring & Maintenance Program, the staff found the enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 2: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the enhancement made:

> ASTM D 5163-96, paragraph 5, defines the inspection frequency to be each refueling outage or during other major maintenance outages as needed. ASTM D 5163-96, paragraph 8, discusses the qualifications for inspection personnel, the inspection coordinator, and the inspection results evaluator. ASTM D 5163-96, subparagraph 9.1, discusses development of the inspection plan and the inspection methods to be used. It states, "A general visual inspection shall be conducted on all readily accessible coated surfaces during a walk-through. After a walk-through, thorough visual inspections shall be carried out on previously designated areas and on areas noted as deficient during the walk-through. A thorough visual inspection shall also be carried out on all coatings near sumps or screens associated with the Emergency Core Cooling System (ECCS)." This subparagraph also addresses field documentation of inspection results. ASTM D 5163-96, subparagraph 9.5, identifies instruments and equipment needed for inspection.

In the LRA, the applicant stated that before the period of extended operation, all coating inspectors will meet the requirements of ANSI N45.2.6, "Qualification of Inspection, Examination, and Testing Personnel for the Construction Phase of Nuclear Power Plants."

The staff review noted that the relevant ASTM standard requires that coating inspectors be qualified in accordance with ANSI N45.2.6 or the ASTM requirements. The staff queried the applicant about the qualification requirement for inspectors. The applicant agreed to add this enhancement. By letter dated August 11, 2005, the applicant stated that before the period of extended operation all coating inspectors will meet ANSI N45.2.6 requirements. The staff determined that this enhancement (i.e., requiring all coating inspectors to be qualified in accordance with ANSI N45.2.6) makes this program consistent with the GALL Report recommendation of qualification under the requirements in paragraph 8 of ASTM D 5163-96, "Standard Guide for Establishing Procedures To Monitor the Performance of Safety Related Coatings in an Operating Nuclear Power Plant," for inspection personnel, inspection coordinators, and inspection results evaluators. On the basis of the above review and its review of operating experience for the Protective Coating Monitoring & Maintenance Program, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 3: The GALL Report recommends the following for the Monitoring and Trending program element associated with the enhancement made:

> ASTM D 5163-96 identifies monitoring and trending activities in subparagraph 6.2, which specifies a pre-inspection review of the previous two monitoring reports, and in subparagraph 10.1.2, which specifies that the inspection report should prioritize repair areas as either needing repair during the same outage or postponed to future outages, but under surveillance in the interim period.

In the LRA, the applicant stated it will include a preinspection review of the previous two inspection reports to identify trends.

The staff review has determined that this enhancement (i.e., a preinspection review of the previous two inspection reports to identify trends) makes this program consistent with the GALL Report recommendation above. On the basis of the above review and its review of operating experience for the Protective Coating Monitoring & Maintenance Program, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 4: The GALL Report recommends the following for the Acceptance Criteria program element associated with the enhancement made:

> ASTM D 5163-96, subparagraphs 9.2.1 through 9.2.6, 9.3, and 9.4, contain guidance for characterization, documentation, and testing of defective or deficient coating surfaces. Additional ASTM and other recognized test methods are identified for use in characterizing the severity of observed defects and deficiencies. The evaluation covers blistering, cracking, flaking, peeling, delamination, and rusting. ASTM D 5163-96, paragraph 11, addresses evaluation. It specifies that the inspection report is to be evaluated by the responsible evaluation personnel, who prepare a summary of findings and recommendations for future surveillance or repair, including an analysis of reasons or suspected reasons for failure. Repair work is prioritized as major or minor defective areas. A recommended corrective action plan is required for major defective areas so that these areas can be repaired during the same outage, if appropriate.

In the LRA, the applicant stated that it will revise the AMP implementation procedures to include analysis of suspected reasons for coating failure.

The staff review determined that this enhancement (i.e., revising implementation procedures to include analysis of suspected reasons for coating failure) makes this program consistent with the GALL Report recommendation. On the basis of the above review and its review of operating experience for the Protective Coating Monitoring & Maintenance Program, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of AMP B2.1.27, "Protective Coating Monitoring and Maintenance Program," that the applicant claimed are consistent with GALL AMP XI.S8 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the enhancements as described above.

Operating Experience. In LRA Section B2.1.27, the applicant explained that it does not rely upon the Protective Coating Monitoring & Maintenance Program to manage the loss of material due to corrosion of carbon steel structural elements. Therefore, only the operating experience concerned with degradation of coatings and their consequential clogging of the ECCS strainers is of importance. Since there currently are no coating inspection requirements for all components inside containment, the only inspection experience to date is from those inspections of the drywell and torus shells. Inspections of the drywell and torus shell have identified the following signs of paint degradation—chipping, rusting, peeling, blistering, cracking, and other signs of degradation. All unacceptable coating degradation has been repaired or in the case of the torus is scheduled for repair during the next torus draining. These inspections have detected and evaluated aging effects before the loss of intended function of the ECCS suction strainers. Where applicable, the applicant made repairs to minimize further degradation of the coatings, which may lead to clogging of the ECCS suction strainers.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the Protective Coating Monitoring & Maintenance Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.27, the applicant provided the USAR supplement for the Protective Coating Monitoring & Maintenance Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant included the commitments to USAR Section A2.1.27, documented as commitments 39, 40, and 41 in Table A.5, which the applicant will complete before the period of extended operation:

(1) The applicant will update procedures to include inspection of all accessible painted surfaces inside containment.

(2) The applicant will revise the program to include a preinspection review of the previous two inspection reports so that trends can be identified.

(3) The applicant will revise implementation procedures to include provisions for analysis of suspected reasons for coating failure.

In a letter dated August 11, 2005, the applicant provided a new commitment, stating that before the period of extended operation, coating inspectors will meet ANSI N45.2.6 requirements.

Conclusion. On the basis of its review and audit of the applicant's Protective Coating Monitoring & Maintenance Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.21 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. In LRA Section B2.1.29, the applicant described the Reactor Vessel Surveillance Program, stating that this existing program is consistent, with enhancement, with GALL AMP XI.M31, "Reactor Vessel Surveillance."

The applicant stated that the Reactor Vessel Surveillance Program is part of the BWRVIP Integrated Surveillance Program (ISP) that uses data from BWR member surveillance programs to select the "best" representative material for monitoring radiation embrittlement for a particular plant. The BWRVIP ISP monitors capsule test results from various member plants.

The program was implemented to comply with Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50. The BWRVIP ISP guidance describes the scope of the Reactor Vessel Surveillance Program. BWRVIP-86-A, "BWR Vessel and Internals Project: BWR Integrated Surveillance Program (ISP) Implementation," includes the ISP capsule removal schedule, and BWRVIP-78, "BWR Vessel and Internals Project: BWR Integrated Surveillance Program (ISP) Plan," describes its technical basis.

The applicant stated in the Detection of Aging Effects program element of the Reactor Vessel Surveillance Program that the ISP performs Charpy V-notch testing on specimens to measure the applicable aging effect, loss of fracture toughness. The applicant further stated that the Reactor Vessel Surveillance Project uses the BWRVIP ISP to monitor the effect of irradiation on the vessel.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B2.1.29 about the applicant's demonstration of the Reactor Vessel Surveillance Program to ensure that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB throughout the period of extended operation.

Appendix H to 10 CFR Part 50 provides the NRC's requirements for implementing surveillance programs required for a plant's reactor vessel beltline materials. The programs are used to monitor for any changes in fracture toughness properties of a plant's reactor vessel beltline base metal and weld materials from neutron irradiation during the plant's service lifetime.

Section III.C of Appendix H to 10 CFR Part 50 provides the specific requirements for implementation of an ISP.

The BWRVIP has developed an ISP for the reactor vessel base metal and weld materials in all operating BWRs. The BWRVIP ISP is in proprietary topical reports BWRVIP-78, "BWR Integrated Surveillance Program (ISP) Plan," and BWRVIP-86, "BWR Vessel and Internals Project: BWR Integrated Surveillance Program (ISP) Implementation." The NRC approved these proprietary reports applying the design and implementation of the ISP by BWRs during their first 40-year operating period in its February 1, 2002, final safety evaluation report to the BWRVIP.

The BWRVIP issued proprietary topical report BWRVIP-116, "BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," to address ISP changes necessary for LRAs for operating BWRs. This report was approved by the NRC in a letter dated March 1, 2006, from M.A. Mitchell (NRC) to B. Eaton (BWRVIP).

The applicant identified the Reactor Vessel Surveillance Program as an existing ISP designed to comply with the requirements for ISPs in Appendix H to 10 CFR Part 50 and to conform with recommended guidelines in GALL AMP XI.M31. The applicant stated that USAR supplement Section A2.1.29 describes the Reactor Vessel Surveillance Program.

The applicant stated that it based the Reactor Vessel Surveillance Program on the BWRVIP ISP as described and discussed in BWRVIP-78 and BWRVIP-86. The ISP provides for a number of surveillance capsules to be removed from specified BWRs and to be available for testing during the license renewal period for the BWR fleet. The ISP establishes acceptable technical criteria for capsule withdrawal and testing.

The staff approved the application of the BWRVIP ISP to the applicant's reactor vessel in the April 22, 2003, SE, in which the staff concurred that the BWRVIP ISP, as approved in BWRVIP-78 and BWRVIP-86-A (the staff-approved version of BWRVIP-86), met requirements in Appendix H to 10 CFR Part 50 for the RPV.

Proprietary topical reports BWRVIP-78 and BWRVIP-86-A, the staff's February 1, 2002, generic final safety evaluation report, and the staff's April 22, 2003, SE provide an acceptable basis for approving the Reactor Vessel Surveillance Program for the current operating period. To address the impacts of license renewal on the program, the applicant will enhance the AMP through the period of extended operation.

The applicant stated that the BWRVIP ISP has been enhanced to address the impact of license extension on the ISP for BWR facilities and that proprietary topical report BWRVIP-116 discusses the enhanced program.

The BWRVIP submitted BWRVIP-116 to the staff in 2003 to address the impacts of license extension on the proposed surveillance capsule withdrawal schedule and to determine whether additional ISP capsules will need to be designated for the proposed surveillance capsule withdrawal schedule.

The staff's review of LRA Section B2.1.29 identified an area for which it needed additional information to complete its evaluation of the applicant's program. The applicant responded to the staff's RAI as discussed below.

In RAI B2.1.29-1, dated September 28, 2005, the staff requested that the applicant commit to enhancing the Reactor Vessel Surveillance Program to ensure that any additional requirements that result from the staff review of BWRVIP-116 will be addressed before the period of extended operation.

In its response, by letter dated October 28, 2005, the applicant stated that it will enhance the Reactor Vessel Surveillance Program to address additional requirements from the staff review before the period of extended operation.

In its letter dated March 15, 2006, the applicant provided commitment 42 in Table A.5, which will ensure that it will incorporate into the Reactor Vessel Surveillance Program any changes to the withdrawal schedule requirements for the ISP, as approved in the staff's acceptance of BWRVIP-116 and found applicable to the reactor vessel, will be incorporated into its RVSP. With this RVSP enhancement included as a commitment for the LRA, the staff found the applicant's response acceptable.

Operating Experience. In the Operating Experience program attribute for the Reactor Vessel Surveillance Program, the applicant stated that it participates in the BWRVIP ISP to ensure the program meets accepted industry practices. The staff has accepted the ISP methodology for monitoring radiation embrittlement at BWRVIP plants as reasonable assurance that the applicant will continue to evaluate aging effects of reactor vessel material loss of fracture toughness by sampling, analysis, and testing. The staff has confirmed that these topical reports and NRC evaluations apply to the staff's approval of the Reactor Vessel Surveillance Program for the applicant's CLB. The staff therefore concluded that the applicant's Operating Experience attribute for the Reactor Vessel Surveillance Program is acceptable.

USAR Supplement. In LRA Section A2.1.29, the applicant provided the USAR supplement for the Reactor Vessel Surveillance Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant included the following commitments to USAR Section A2.1.29, documented as commitments 42 and 43 in Table A.5:

(1) NMC intends to use the ISP for MNGP during the period of extended operation by implementing the requirements of BWRVIP-116, which the NRC is currently reviewing.

(2) NMC will retain the capsules removed from the MNGP reactor vessel as part of the Reactor Vessel Surveillance Program.

Conclusion. On the basis of its review and audit of the applicant's Reactor Vessel Surveillance Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancement and confirmed that its implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.22 Selective Leaching of Materials Program

Summary of Technical Information in the Application. In LRA Section B2.1.30, the applicant described the Selective Leaching of Materials Program, stating that this new program is consistent, with exception, with GALL AMP XI.M33, "Selective Leaching of Materials." The program includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. In situations where hardness testing is not practical, the applicant will use a qualitative method by other NDE or metallurgical methods to determine the presence and extent of selective leaching. The program will determine if selective leaching is occurring for selected components. The applicant will write any required instructions or procedures during development of the program, and may use existing MNGP procedures or work instructions.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the exception and the associated justifications to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP XI.M33.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M33 in the GALL Report.

Exceptions 1 and 2: The GALL Report recommends the following for the Detection of Aging Effects program element associated with the exceptions taken:

> The one-time visual inspection and hardness measurement includes close examination of a select set of components to determine whether selective leaching has occurred and whether the resulting loss of strength and/or material will affect the intended functions of these components during the period of extended operation. Selective leaching generally does not cause changes in dimensions and is difficult to detect. However, in certain brasses it causes plug-type dezincification, which can be detected by visual inspection. One acceptable procedure is to visually inspect the susceptible components closely and conduct Brinell Hardness testing on the inside surfaces of the selected set of components to determine if selective leaching has occurred. If it is occurring, an engineering evaluation is initiated to determine acceptability of the affected components for further service.

In the LRA, the applicant stated that the first exception is that the program may use hardness testing, other than Brinell hardness testing, to detect selective leaching of material. In the second exception, the applicant stated that it will use qualitative methods in lieu of hardness testing to detect selective leaching where hardness testing is not practical.

The staff discussed these exceptions with the applicant's technical personnel. With regard to Exception 1, the staff concurred that Brinell hardness testing is one of several methodologies that are currently being used and is only a GALL Report recommendation. The staff found the applicant's position acceptable. With regard to Exception 2, the staff asked that the applicant clarify the use of qualitative methods versus hardness testing.

In its letter dated August 11, 2005, the applicant stated that the methods used to detect selective leaching include visual inspection in conjunction with mechanistic techniques like scratch testing, hardness testing, or NDEs. The staff found the applicant's position acceptable because the applicant is using qualitative mechanistic techniques in addition to visual inspection, as recommended by the GALL Report.

The staff reviewed those portions of AMP B2.1.30, "Selective Leaching of Materials Program," that the applicant claimed are consistent with GALL AMP XI.M33 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exceptions as described above.

Operating Experience. In LRA Section B2.1.30, that applicant stated that the Selective Leaching of Materials Program is a new program with no operating experience.

During the audit and review, the staff asked the applicant how it captures operating experience. The applicant indicated that the CAP identifies, tracks, and trends site operating experience related to all site components. The site CAP database documents any site components identified as degraded, as failed, or as potentially unable to fulfill intended functions. Plant engineering staff then evaluate these CAPs for the extent of the condition and take appropriate followup actions. Plant engineering staff also trend related CAP data to identify generic issues. They address trended site issues in program health reports presented to site management on a scheduled basis. The CAP also addresses 10 CFR 54.21 issues and external operating events from the NRC, INPO, LIS, and the applicant's fleet. The staff reviewed the applicant's response and found it acceptable.

A review of CRs for leaching identified a possible selective leaching issue, a higher than normal lead content in the number 12 EDG lube oil. A document review indicated that INPO SOER 80-04 recommends that if lead soldered joint coolers are installed, there should be inspections for exfoliation-type solder corrosion. A work history review determined that the number 11 EDG lube oil cooler had been replaced with the rolled tube design in 1991, but that the number 12 EDG lube oil cooler still had its original cooler. The applicant replaced the number 12 EDG lube oil cooler during the 2003 refueling outage with a rolled tube design.

The staff recognized that the CAP captures, evaluates, and incorporates internal and external plant operating experience for objective evidence of adequate management of aging effects.

USAR Supplement. In LRA Section A2.1.30, the applicant provided the USAR supplement for the Selective Leaching of Materials Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant included the commitment to USAR Section A2.1.30, documented as commitment 44 in Table A.5, that before the period of extended operation, it will implement the Selective Leaching of Materials Program as a new program consistent, with exceptions, to the recommendations of GALL AMP XI.M33.

Conclusion. On the basis of its review and audit of the applicant's Selective Leaching of Materials Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exception and the associated justifications and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.23 Structures Monitoring Program

Summary of Technical Information in the Application. In LRA Section B2.1.31, the applicant described the Structures Monitoring Program, stating that this existing program is consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program." The Structures Monitoring Program is based on the guidance provided in RG 1.160, Revision 2, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," issued March 1997, and NUMARC 93-01, Revision 2, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," issued April 1996. The applicant implements the Structures Monitoring Program as part of the structures monitoring done under the MNGP Maintenance Rule program and with additional inspections of the intake structure and diesel fuel oil transfer house. The Structures Monitoring Program also implements GALL AMP XI.S5, "Masonry Wall Program." Masonry block wall inspections are performed as part of the Maintenance Rule inspections and are based on Inspection and Enforcement Bulletin 80-11 with administrative controls in accordance with IN 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11," dated December 21, 1987. As permitted by GALL AMP XI.S7, "RG 1.127, *Inspection of Water-Control Structures* Associated with Nuclear Power Plants," the Structures Monitoring Program includes the inspection of water control structures. The only water control structure in scope for license renewal is the intake structure. Maintenance Rule inspections are performed on the portions of the intake structure above the water line. The Structures Monitoring Program includes separate inspections of the underwater portions of the intake structure. In addition, special settlement checks of the diesel fuel oil transfer house are performed outside the Maintenance Rule inspections. The Structures Monitoring Program does not rely upon protective coatings to manage the effects of aging.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the *documents cited in the staff's audit and review report, which assesses the consistency of the* AMP elements with GALL AMP XI.S6.

In the LRA, the applicant stated that it will implement the following enhancements to make this AMP consistent with the recommendations in the GALL Report.

Enhancement 1: The GALL Report recommends the following for the Scope of Program program element for GALL AMPs XI.S5 and XI.S7 associated with the enhancement made:

> The scope includes all masonry walls identified as performing functions in accordance with 10 CFR 54.4.
>
> RG 1.127 applies to water-control structures associated with emergency cooling water systems or flood protection of nuclear power plants.

The applicant indicated that it is not committed to RG 1.127, Revision 1, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," March 1978. The Structures Monitoring Program includes inspections of water control structures as recommended by the GALL Report.

In the LRA, the applicant stated that it will expand the Structures Monitoring Program, as necessary, to include inspections of structures and structural elements within the scope of license renewal not inspected as part of another AMP.

According to AMP B2.1.31, "Structures Monitoring Program," the program includes masonry block walls and water control structures within the scope of license renewal. The Scope of Program program element lists water control structures, which include the access tunnel and diesel fire pump house.

On the basis of its review of Structures Monitoring Program operating experience and based on satisfying the GALL Report recommendations as discussed above, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 2: The GALL Report recommends the following for the Scope of Program program element for GALL AMP XI.S7 associated with the enhancement made:

> The water-control structures included in the RG 1.127 program are concrete structures; embankment structures; spillway structures and outlet works; reservoirs; cooling water channels and canals, and intake and discharge structures; and safety and performance instrumentation.

In the LRA, the applicant stated that it will enhance implementing procedures for the Structures Monitoring Program to ensure that structural inspections are performed on submerged portions of the intake structure from the service water bays to the wing walls.

The applicant stated, in the LRA, that the Structures Monitoring Program includes separate inspections of the underwater portions of the intake structure and that under the Scope of Program element, the program also provides inspection requirements to manage aging effects described in the Parameters Monitored or Inspected element. As documented in the audit and review report, the applicant's structural inspections of the service water bays will include more detailed inspection criteria. In addition, the frequency of the applicant's structural inspections of the submerged portions of the intake structure will meet or exceed that required by American Concrete Institute (ACI) 349.3R-96, "Evaluation of Existing Nuclear Safety Related Concrete Structures."

On the basis of its review of Structures Management Program operating experience and based on satisfying the GALL Report recommendations as discussed above, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 3: The GALL Report recommends the following for the Parameters Monitored or Inspected program element associated with the enhancement made:

> ...ACI 349.3R-96 and ANSI/ASCE 11-90 provide an acceptable basis for selection of parameters to be monitored or inspected for concrete or steel structural elements...

In the LRA, the applicant stated that it will enhance existing implementing procedures for the Structures Monitoring Program to include monitoring/inspection parameters for structural components within the scope of license renewal.

The staff reviewed the Structures Monitoring Program PBD, which incorporates intake structures and masonry walls, and found it to be in general agreement with the above recommendations.

On the basis of its review of Structures Management Program operating experience and based on satisfying the GALL Report recommendations as discussed above, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancements 4 and 5: The GALL Report recommends the following for the Parameters Monitored or Inspected program element associated with the enhancement made:

> Parameters monitored or inspected are to be commensurate with industry codes, standards and guidelines, and are to also consider industry and plant-specific operating experience.

In the LRA, the applicant stated that it will enhance the Structures Monitoring Program to sample ground water for pH, chloride concentration, and sulfate concentration.

The applicant stated, in the LRA, that to ensure that the soil environment remains nonaggressive, it will enhance the Structures Monitoring Program to include periodic ground-water sampling for pH, chloride concentration, and sulfate concentration. The PBD reiterates this statement, providing the limiting values of pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm for a nonaggressive environment.

On the basis of its review of Structures Management Program operating experience and based on satisfying the GALL Report recommendations as discussed above, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

In the LRA, the applicant stated that it will enhance the Structures Monitoring Program to include concrete evaluations of inaccessible areas if degradation of accessible areas is detected to ensure the soundness of the buried concrete. The PBD reiterates this statement.

On the basis of its review of the Structures Management Program operating experience and based on satisfying the GALL Report recommendations as discussed above, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

Enhancement 6: The GALL Report recommends the following for the Acceptance Criteria program element of GALL AMP XI.S7 associated with the enhancement made:

> "Evaluation Criteria" provided in Chapter 5 of ACI 349.3R-96 provides acceptance criteria (including quantitative criteria) for determining the adequacy of observed aging effects and specifies criteria for further evaluation. Although not required, plant-specific acceptance criteria based on Chapter 5 of ACI 349.3R-96 are acceptable.

In the LRA, the applicant stated that it will enhance the implementing procedures for the Structures Monitoring Program to include acceptance criteria for structural inspections of submerged portions of the intake structure.

The applicant's technical personnel stated that for structural components of the intake structure in a raw water/river water environment, acceptance criteria will be based on relevant industry codes and standards. ACI 349.3R-96 will guide evaluation of concrete degradation.

On the basis of its review of Structures Monitoring Program operating experience and based on satisfying the GALL Report recommendations as discussed above, the staff found this enhancement acceptable as such changes to the applicant's program provide assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of AMP B2.1.31, "Structures Monitoring Program," that the applicant claimed are consistent with GALL AMP XI.S6 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the enhancements as described above.

Operating Experience. In LRA Section B2.1.31, the applicant stated that the Structures Monitoring Program, including the Masonry Block Wall Program and RG 1.127 and implemented through the Maintenance Rule and other procedures, has detected aging effects of structural components and has ensured that repairs were made in a timely manner before the loss of intended function. The program also evaluates external operating experience for impact on structures and structural inspections through administrative procedures and the corrective action process.

The two most recent inspections, performed in 1998 and 2001/2002, noted several deficiencies. The 1998 inspection noted 21 deficiencies and the 2001/2002 inspection noted 30 deficiencies. However, not all of these deficiencies were directly attributed to an aging effect. The aging effects detected during the structural inspections were concrete spalling, cracking, surface deterioration and flaking, grout deterioration, corroded rebar or other steel components, and cracked welds. Applicant personnel created WOs and/or corrective actions to repair the deficiencies. Several deficiencies were evaluated and determined to be acceptable as-is and subjected to further inspections.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Structures Monitoring Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.31, the applicant provided the USAR supplement for the Structures Monitoring Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

By letter dated June 10, 2005, the applicant included the following commitments to USAR Section A2.1.31 that it will perform before the period of extended operation:

(1) The program will be expanded, as necessary, to include inspections of structures and structural elements in scope for License Renewal that are not inspected as part of another aging management program.

(2) Implementing procedures will be enhanced to ensure that structural inspections are performed on submerged portions of the Intake Structure from the service water bays to the wing walls.

(3) Implementing procedures will be revised to include the monitoring/inspection parameters for structural components within the scope of License Renewal.

(4) The program will be enhanced to include a requirement to sample ground water for pH, chloride concentration and sulfate concentration.

(5) The program will be enhanced to include concrete evaluations of inaccessible areas if degradation of accessible areas is detected.

(6) Implementing procedures will be enhanced to include acceptance criteria for structural inspections of submerged portions of the Intake Structure.

Conclusion. On the basis of its review and audit of the applicant's Structures Monitoring Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.2.24 Metal Fatigue of the Reactor Coolant Pressure Boundary Program

Summary of Technical Information in the Application. In LRA Section B3.2, the applicant described the Metal Fatigue of the Reactor Coolant Pressure Boundary Program, stating that this existing program is consistent, with enhancement, with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." The Metal Fatigue of the Reactor Coolant Pressure Boundary Program is part of the Thermal Fatigue Monitoring Program (FMP). The MNGP Thermal FMP provides for the periodic review of plant transients for impact on selected components. In addition, environmental effects have been evaluated in accordance with NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves for Selected Nuclear Power Plant Components." Selected components were evaluated using material specific guidance presented in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," issued February 1998, for carbon and low alloy steels and in NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," issued April 1999. The MNGP program ensures that limiting components remain within the acceptance criteria for cumulative fatigue usage throughout the licensed term and, if trends indicate otherwise, appropriate corrective action can be implemented.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The MNGP audit and review report details the staff's audit evaluation of this AMP. The staff reviewed the enhancement and the associated justifications to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical personnel and reviewed, in whole or in part, the documents cited in the staff's audit and review report, which assesses the consistency of the AMP elements with GALL AMP X.M1.

In the LRA, the applicant stated that it will implement the following enhancement to make this AMP consistent with the recommendation in the GALL Report.

Enhancement: The GALL Report recommends the following for the Scope of Program program element associated with the enhancement made:

> The program includes preventive measures to mitigate fatigue cracking of metal components of the reactor coolant pressure boundary caused by anticipated cyclic strains in the material.

In the LRA, the applicant stated that it will incorporate requirements for inclusion of NUREG/CR-6260 locations in implementing procedures for the Thermal FMP.

During the audit and review, the staff noted that this enhancement also affects the Monitoring and Trending program element as described in GALL AMP X.M1.

The GALL Report recommends the following for the Monitoring and Trending program element:

> The program monitors a sample of high fatigue usage locations. As a minimum, this sample is to include the locations identified in NUREG/CR-6260.

The staff found the applicant's enhancement to the Metal Fatigue of the Reactor Coolant Pressure Boundary Program (to include all NUREG/CR-6260 locations in implementing procedures for the Thermal FMP necessary for consistency with the GALL Report AMP description and acceptable.

During the audit and review, the staff asked whether the applicant has plant-specific locations where fatigue cumulative usage factors (CUFs) are projected to be higher than the values projected for NUREG/CR-6260 locations. In response, the applicant stated that the LRA identified other areas as acceptable in accordance with 10 CFR 54.21(c)(1)(iii) projected to have cumulative fatigue usage values higher than those for NUREG/CR-6260 locations. The applicant stated that it will revise its FMP to include these locations as well as the NUREG/CR-6260 locations. The applicant stated that it updates fatigue evaluations conducted in accordance with this program once per cycle and projects them to a 60-year end of life (EOL) and that it will take appropriate corrective actions for any locations projected to exceed the code acceptance criteria for fatigue before its occurrence.

The staff reviewed the applicant's response together with the pertinent section of the LRA. Because the applicant's Thermal Fatigue Management Program includes most limiting locations and all of the applicable NUREG/CR-6260 locations, the staff found the applicant's response acceptable.

For the "Acceptance Criteria" program element, the applicant indicated that an alternative approach will be taken if the fatigue usage limit for the monitored components can not be demonstrated to remain less than 1.0. In accordance with GALL program X.M1; acceptable corrective actions include a more rigorous analysis of the component to demonstrate that the design code limit will not be exceeded, repair, or replacement of the component. The applicant indicated that an alternative approach would be to show that potential cracking is maintained below the criteria of ASME Section XI, Appendix L, or an approved NRC limit. The staff has not endorsed an alternative approach which relies on inspection in lieu of meeting the ASME Code fatigue limit of 1.0. The staff notes that, if this alternative option is selected, the inspection details, including scope, qualification, method, and frequency must be provided to the NRC for review and approval prior to the period of extended operation. An aging management program under this option would be a departure from the design basis CUF evaluation, described in the USAR supplement, and therefore, would require a license amendment pursuant to 10 CFR 50.59.

The staff reviewed those portions of AMP B3.2, "Metal Fatigue of the Reactor Coolant Pressure Boundary Program," that the applicant claimed are consistent with GALL AMP X.M1 and found them consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the enhancement as described above.

Operating Experience. In LRA Section B3.2, the applicant explained that the MNGP technical staff monitors industry operating experience through peer groups, industry information (e.g., INs, licensee event reports, SILs), and by communications with other plant's subject matter experts. The staff evaluates information from these sources for impact on the Metal Fatigue of the Reactor Coolant Pressure Boundary Program. In addition, the MNGP technical staff updates internal operating experience to account for operating cycles and their effect on fatigue of limiting components on a frequency of at least once per refueling cycle. This ensures the adequacy of the program in terms of providing a periodic means of evaluating fatigue margins and establishing corrective action plans as necessary. For example, in May 1999, MNGP experienced several transients as indicated by FW and RWCU flow data. Subsequent review concluded that these transients could have an impact on FW nozzle fatigue usage and that they did not conform to the transient descriptions that will normally be considered in the Thermal FMP. An evaluation of these transients found that the effect on fatigue was not significant (0.003 addition). However, the applicant incorporated the results into the Thermal FMP which is updated at least once every refueling cycle. The MNGP CAP database documents this operating experience.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its evaluation of the applicant's program against the program elements described in the GALL Report AMP, its review of the above industry and plant-specific operating experience, and its discussions with the applicant's technical personnel, the staff concluded that the applicant's Metal Fatigue of the Reactor Coolant Pressure Boundary Program will adequately manage the aging effects identified in LRA for which this AMP is credited.

USAR Supplement. In LRA Section A4.2, the applicant provided the USAR supplement for the Metal Fatigue of the Reactor Coolant Pressure Boundary Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

By letter dated June 10, 2005, the applicant included commitment 52, that before the period of extended operation, it will incorporate requirements for inclusion of NUREG/CR-6260 locations in implementing procedures for the Thermal Fatigue Monitoring Program; however, USAR supplement Section A4.2 did not capture this commitment. The applicant stated that it will update the USAR supplement to include the commitment in the annual LRA update letter. In its letter dated February 28, 2005, the applicant provided a revision to USAR supplement Section A4.2, which included the commitment.

Conclusion. *On the basis of its review and audit of the applicant's* Metal Fatigue *of the* Reactor Coolant Pressure Boundary Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancement and confirmed that its implementation before the period of extended operation will result in the existing AMP being consistent with the GALL Report AMP to which it was credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified the following plant-specific AMPs:

- Bus Duct Inspection Program (B2.1.6)
- System Condition Monitoring Program (B2.1.32)

For AMPs that are not consistent with or not addressed by the GALL Report, the staff performed a complete review of the AMPs to determine if they are adequate to manage aging. The following sections of this SER document the staff's review of these plant-specific AMPs.

3.0.3.3.1 Bus Duct Inspection Program

Summary of Technical Information in the Application. In LRA Section B2.1.6, the applicant described the Bus Duct Inspection Program, stating that this new program will be consistent with the applicable 10 elements described in SRP-LR Appendix A. In the LRA, the applicant stated that the primary purpose of this new, plant-specific program is to demonstrate that aging effects will be adequately managed so that nonsegregated bus ducts within the scope of license renewal will perform their intended function in accordance with the CLB during the period of extended operation. The intended function of nonsegregated bus ducts is to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in LRA Section B2.1.6 regarding the applicant's demonstration of the Bus Duct Inspection Program to ensure that the effects of aging, as discussed above, will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation.

The applicant credited the Bus Duct Inspection Program with aging management of the nonsegregated phase bus. The applicant stated that the Bus Duct Inspection Program is a new plant-specific program. Its purpose is to demonstrate that the aging effects caused by ingress of moisture or contaminants (dust and debris), insulation degradation from heat or radiation in the presence of oxygen, and bolt relaxation from thermal cycling will be adequately managed so that the nonsegregated bus ducts subject to an AMR will perform their intended function in accordance with the CLB during the period of extended operation.

To determine whether the applicant's AMP is adequate to manage the effects of aging so that intended functions will be maintained consistent with the CLB for the period of extended operation, the staff evaluated the (1) scope of program, (2) preventive actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, and (7) operating experience. SER Section 3.0.4 provides the staff's evaluation of the applicant's corrective actions, confirmation process, and administrative controls.

(1) Scope of Program—This program applies to all bus ducts within the scope of license renewal. *The program manages the aging effects for components in the offsite power/station* blackout (SBO) recovery path commodity group. The staff reviewed the specific components that the program identified.

The staff confirmed that the Scope of Program element satisfies the SRP-LR A.1.2.3 criterion. The program includes all bus ducts within the scope of license renewal. On this basis, the staff found the applicant's program scope acceptable.

(2) Preventive Actions—The Bus Duct Inspection Program monitors conditions. The program does not include any actions to prevent or mitigate aging degradation, and the staff identified no need for such actions.

The staff confirmed that the Preventive Actions element satisfies the SRP-LR A.1.2.3 criterion. The staff identified no need for preventive actions for this AMP as a condition monitoring program. On this basis, the staff found the applicant's Preventive Actions program element acceptable.

(3) Parameters Monitored or Inspected—The applicant stated that this program will check a sample of accessible bolted connections (bus joints and ending devices) for proper torque, or the resistance of bolted joints for resistance with a micro-ohmmeter of sufficient current capacity for checking bus bar connections. This program will also inspect internal portions of accessible bus ducts for cracks, corrosion, foreign debris, dust buildup, and moisture intrusion. The applicant will inspect the bus insulating system for signs of embrittlement, cracking, melting, swelling, or discoloration that may indicate overheating or aging degradation. It will inspect the bus supports for structural integrity and cracking.

The staff confirmed that the Parameters Monitored or Inspected element satisfies the SRP-LR A.1.2.3 criteria and is capable of detecting the presence and extent of aging effects. On this basis, the staff found the applicant's Parameters Monitored or Inspected program element acceptable.

(4) Detection of Aging Effects—The applicant stated that this program visually inspects internal portions of bus ducts, the bus insulating system, and the bus supports. In addition, a torque test or resistance test of a sample of accessible bolted connections will be performed. The applicant will complete the program before the end of the initial 40-year license term and every 10 years thereafter, a period adequate for preventing failures of the bus ducts as experience shows that aging degradation is a slow process. A 10-year inspection frequency provides two data points during a 20-year period to characterize the degradation rate.

In RAI B2.1.6-1, dated November 7, 2005, the staff noted that vendors do not recommend the re-torque of bolted connections unless the joint requires service or the bolted connections are clearly loose. The torque required to turn the fastener in the tightening direction (restart torque) is not a good indication of the preload after the fastener is in service. Because of relaxation of parts of the joint, the final loads are likely to be lower than the installed loads; therefore, the staff requested that the applicant justify that re-torquing of bolted connections is a good indicator of the preload after the fastener is in service.

In its response dated December 7, 2005, the applicant stated that it will follow the guidance of EPRI TR-104213, Section 8.2, "Inspection of Electrical Bolted Joints," which does not recommend re-torquing of bolted connections. It will check a sample of accessible bolted connections loose connections by thermography or by connection resistance measurement with a low-range ohmmeter. Metal enclosed bus (MEB) internal surfaces will be visually inspected for aging degradation of insulating material, foreign debris and excessive dust buildup, and evidence of moisture intrusion. Bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration that may indicate overheating or aging degradation. Internal bus supports will be visually inspected for structural integrity and cracks. The applicant will complete this program before the period of extended operation and every 10 years thereafter if visual inspection is not used to check bolted connections. A 10-year inspection interval will provide two data points during a 20-year period to characterize the degradation rate. This inspection frequency is adequate to prevent failures of the MEBs, as experience shows that aging degradation is a slow process.

The applicant will use visual inspection as an alternative to thermography or connection resistance measurement for accessible bolted connections covered with heat-shrink tape, sleeving, insulating boots, and other materials. Visual inspection of the insulation material will detect surface anomalies, such as discoloration, cracking, chipping, or surface contamination. When this alternative visual inspection is used to check bolted connections, the first inspection will be completed before the period of extended operation and every 5 years thereafter.

Based on its review, the staff found that the visual inspection of bus ducts and internal bus supports will indicate aging effects and that thermography or resistance checks of a sample of bolted joints will ensure that bolted connections do not loosen from ohmic heating. The staff also found that the 10-year inspection frequency is adequate to prevent failures of bus ducts as industry experience shows that the aging degradation is a slow process. Therefore, the staff's concern described in RAI B2.1.6-1 is resolved.

The staff confirmed that the Detection of Aging Effects element satisfies SRP-LR Section A.1.2.3 criteria and is capable of detecting the presence and extent of aging effects. On this basis, the staff found the applicant's proposed Detection of Aging Effects program element acceptable.

(5) Monitoring and Trending—The applicant stated that this program does not include trending actions because the ability to trend inspection results is limited. The staff found this acceptable because trending will be performed under a controlled administrative process.

The staff confirmed that the Monitoring and Trending element satisfies SRP-LR Section A.1.2.3 criteria, as it takes into consideration plant-specific and industry operating experience. On this basis, the staff found the applicant's proposed Monitoring and Trending program element acceptable.

(6) Acceptance Criteria—The applicant stated that in this program, bolted connections must meet the manufacturer's minimum torque specifications or the resistance of bolted joints must meet required specifications. Bus ducts must be free from any surface anomalies that suggest

conductor insulation degradation exists. An additional acceptance criterion requires no indication of unacceptable corrosion, cracking, foreign debris, dust buildup, or moisture intrusion. Any condition or situation that, if not corrected, could lead to a loss of intended function is considered unacceptable.

As discussed above, the staff expressed concern about re-torquing of the bolted connections. The applicant stated that it will revise its acceptance criteria to remove reference to checking the torque of bolted connections, and to use thermography or resistance checks of a sample of bolted joints for reasonable assurance that bolted connections do not loosen from ohmic heating. In its letter dated February 28, 2006, the applicant revised the acceptance criteria to remove reference to checking bolt torque, which resolved the staff's concern.

The staff confirmed that the Acceptance Criteria element satisfies SRP-LR A.1.2.3 criteria. The Acceptance Criteria element provides a basis for evaluation of the need for corrective actions to ensure that the bus duct intended function will be maintained during the period of extended operation. On this basis, the staff found the applicant's Acceptance Criteria program element acceptable.

After reviewing the Corrective Actions program element, the staff identified an area for which it needed additional information to complete its evaluation of the applicant's Bus Duct Inspection Program. In RAI B2.1.6-2, dated November 7, 2005, the staff noted that, with regard to this element, the applicant had stated that requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants," to 10 CFR Part 50 apply; however, it is the staff's position that the Corrective Actions element should provide for further investigation and evaluation when acceptance criteria are not met. Corrective actions may include but are not limited to cleaning, drying, increased inspection frequency, repair, or replacement of the affected metal enclosed bus components. If an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation applies to other accessible or inaccessible metal enclosed bus. Therefore, the staff requested that the applicant revise the corrective actions in LRA Section B2.1.6 to add specific requirements or justify why corrective actions are not necessary.

In its response, by letter dated December 7, 2005, the applicant stated that it will add the following statement to the Corrective Actions element:

> Further investigation and evaluation are performed when the acceptance criteria are not met. Corrective actions may include, but are not limited to, cleaning, drying, increased inspection frequency, replacement, or repair of the affected metal enclosed bus components. If an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible metal enclosed bus.

Based on its review, the staff found the applicant's response to RAI B2.1.6-2 acceptable; therefore, the staff's concern described in RAI B2.1.6-2 is resolved.

The staff confirmed that the Corrective Actions element satisfies the SRP-LR A.1.2.3 criteria. The Corrective Actions element describes actions to be taken when the acceptance criteria are not met to ensure that the bus duct intended function will be maintained during the period of extended operation. On this basis, the staff found the applicant's Corrective Actions program element acceptable.

Operating Experience. In LRA Section B2.1.6, the applicant explained that the Bus Duct Inspection Program is a new program and no site operating experience exists. Industry operating experience has demonstrated that the failures of bus ducts are caused by cracked insulation of the bus combined with moisture or debris buildup internal to the bus ducts. It has also been shown that bus duct internals exposed to appreciable ohmic heating during operation may experience loosening of bolted connections related to repeated cycling of connected loads. The staff found that the proposed program will ensure that bus ducts are not exposed to excessive ohmic or ambient heating.

USAR Supplement. In LRA Section A2.1.6, the applicant provided the USAR supplement for the Bus Duct Inspection Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

In its letter dated June 10, 2005, the applicant added a commitment to USAR Section A2.1.6, documented as commitment 17 in Table A.5, which states that before the period of extended operation, the applicant will implement the Bus Duct Inspection Program consistent with the appropriate 10 elements described in Appendix A to the SRP-LR.

Conclusion. On the basis of its review and audit of the applicant's Bus Duct Inspection Program, the staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.3.3.2 System Condition Monitoring Program

Summary of Technical Information in the Application. In LRA Section B.2.1.32, the applicant described its System Condition Monitoring Program". The applicant stated that this existing plant-specific MNGP program with enhancements, will be consistent with the applicable 10 elements described in SRP-LR Appendix A.

The applicant stated that the System Condition Monitoring Program is an existing plant-specific program that is based on system engineer monitoring. Although MNGP performs many monitoring activities, this AMP brings aging management into the scope of the monitoring activities. Other groups augment this program by identifying and reporting adverse material conditions via the corrective action process or work control process. This monitoring consists of system-level performance monitoring, inspections and walkdowns, health and status reporting, and PM.

The applicant will enhance this program to include specific activities and criteria for managing age-related degradation for SSCs within the scope of license renewal. This program manages aging effects for normally accessible external surfaces of piping, tanks, hangers and supports, racks, panels, and other components and equipment within the scope of license renewal. These aging effects are managed through visual inspection and monitoring of external surfaces for leakage and evidence of material degradation.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in LRA Section B2.1.32 to demonstrate that the System Condition Monitoring Program will ensure that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the System Condition Monitoring Program against the AMP elements found in the GALL Report, SRP-LR Section A.1.2.3, and SRP-LR Table A.1-1, and focused on the program's management of aging effects through the effective incorporation of the 10 program elements. The applicant indicated that the site-controlled Quality Assurance Program includes the corrective actions, confirmation process, and administrative controls. SER Section 3.0.4 discusses the staff's evaluation of the Quality Assurance Program.

(1) Scope of Program—The applicant stated that the System Condition Monitoring Program visually inspects and monitors the accessible external surfaces of systems and components within the scope of license renewal for signs of excessive and/or abnormal aging effects and material degradation. The System Condition Monitoring Program consists of activities that manage the aging effects for components of various mechanical and civil/structure systems, including alternate nitrogen supply, automatic pressure relief, chemistry sampling, circulating water (CWT), combustible gas control (CGC), condensate and FW, condensate storage, CRD, CSP, demineralized water, EDGs, emergency filtration train, ESW, FIR, fuel pool cooling and cleanup (FPC), hangers and supports, HTV, HPCI, AIR, main condenser (MC), MST, primary containment mechanical, radwaste solid and liquid, reactor building, RBC, reactor core isolation cooling (RCIC), reactor head vent, REC, reactor vessel instrumentation, RWCU, RHR, secondary containment, service and seal water, SLC, turbine generator, and wells and domestic water.

The staff's review of LRA Section B2.1.32 identified areas for which it needed additional information to complete its evaluation of the applicant's program elements. The applicant responded to the staff's RAIs as discussed below.

In RAI B2.1.32-1, dated July 20, 2005, the staff requested that the applicant list any inaccessible surfaces of components (including lagged/insulated piping <212 °F) to be managed by this program and discuss the bases for determining that the inaccessible surfaces will be adequately managed.

In its response, by letter dated August 16, 2005, the applicant stated the following:

> The System Condition Monitoring Program manages aging effects through visual inspection and monitoring of SSCs that are accessible during normal operation, during refueling outages, or as part of planned maintenance.
>
> Accessible areas are those areas that are available for inspection and monitoring during routine operations or that become accessible for inspection and monitoring during refueling or maintenance activities. Insulated piping can be made accessible, as needed, for inspection and monitoring for the presence of age related degradation of SSCs within the scope of license renewal. For

example, insulated piping at operating temperatures >212 degrees F can normally be evaluated for aging effects based on the inspection of uninsulated piping of the same materials in the same environment. Because of this temperature, a wetted environment is not expected. For insulated piping operating <212 degrees F (e.g., HVAC cooling loops), inspections will include removal of insulation where it is determined that inspections of uninsulated portions cannot be extrapolated for managing relevant aging effects.

Visual inspections will be performed of observable indicators that detect age-related degradation. Examples of observable indicators are crack-like indications, corrosion, erosion, leakage, presence of moisture (condensation), or physical displacement.

Inaccessible areas are those areas that have no access due to facility construction (i.e., require a plant modification to access) or that present a significant health, safety, and/or radiological hazard. SSCs that require aging management that are inaccessible will be evaluated for the impact of aging based on comparable accessible locations. This evaluation will be performed on accessible SSCs on the basis of same material(s) and the same or more severe environment(s) as those portions that are considered inaccessible.

If an unacceptable condition or situation is identified in an accessible portion of a system, an extent of condition evaluation will be performed to determine whether the same condition or situation is applicable to other accessible or inaccessible portions of the system. Appropriate follow-up inspection and corrective actions will be implemented as needed.

Based on its review, the staff found the applicant's response to RAI B2.1.32-1 acceptable. The applicant stated that it will evaluate inaccessible surfaces for the impact of aging based on comparable accessible locations. For insulated piping, inspections will include removal of insulation where inspections of uninsulated portions cannot be extrapolated. This will allow for managing relevant aging effects consistent with the staff's position for management of inaccessible surfaces for the External Surfaces Monitoring Program in Revision 1 of the GALL Report. Therefore, the staff's concern described in RAI B2.1.32-1 is resolved.

The staff confirmed that the Scope of Program element satisfies the SRP-LR A.1.2.3 criteria. The scope of the program identifies mechanical, civil, and structural components from various systems included in the program. On this basis, the staff found the applicant's program scope acceptable.

(2) Preventive Actions—The applicant stated that no preventive actions are associated with this AMP, the objective of which is to identify and manage aging effects of concern before the loss of intended function (i.e., condition monitoring).

The staff confirmed that the Preventive Actions element satisfies the SRP-LR A.1.2.3 criteria. The staff identified no need for preventive actions for this AMP as a condition monitoring program. On this basis, the staff found the applicant's Preventive Actions program element acceptable.

(3) Parameters Monitored or Inspected—The applicant stated that the System Condition Monitoring Program uses periodic plant system inspections and walkdowns to monitor for material degradation of mechanical systems/components and civil structures. It will also inspect hanger and support, rack, panel, and anchorage material condition for excessive and/or abnormal material degradation conditions such as cracking, paint deterioration (an indicator of possible underlying degradation), loose, worn or missing parts/components, fluid leaks, bolting or fastener degradation, evidence of corrosion, sealant deterioration, and other problems. It will revise implementing instructions and procedures to include specific parameters to be monitored and inspected. These parameters will be generated based on industry practices from INPO, EPRI, and other organizations.

The staff confirmed that the Parameters Monitored or Inspected element satisfies the SRP-LR A.1.2.3 criteria and is capable of detecting the presence and extent of aging effects. On this basis, the staff found the applicant's Parameters Monitored or Inspected program element acceptable.

(4) Detection of Aging Effects—The applicant stated that the readily accessible external surfaces of various components (e.g., pump casings, valve bodies, piping, expansion joints) are visually inspected for leakage and evidence of excessive and abnormal material degradation. The minimum walkdown frequency is once per year for systems and components accessible during normal operation. The inspection frequency may be increased according to the safety significance, production significance, and/or operating experience of each system. The applicant inspects systems and components accessible only during plant outages at least once per refueling interval.

In RAI B2.1.32-2, dated July 20, 2005, the staff requested that the applicant discuss the inspection methods and acceptance criteria for the aging effects listed below:

a) change in material properties and cracking for neoprene ventilation seals in ESF systems,

b) SCC for stainless steel piping and fittings in auxiliary systems,

c) crevice corrosion for steel and copper alloy components in the auxiliary systems,

d) crevice corrosion for copper alloy components in the steam and power conversion systems,

e) SCC and crevice corrosion for stainless steel spent fuel pool liner.

In its response, by letter dated August 16, 2005, the applicant stated the following:

> The methods and techniques for the detection of the above aging effects will be accomplished in accordance with the recommendations of industry guidelines. Direct visual inspection may be augmented by the use of tools such as mirrors, binoculars, and flashlights. EPRI documents will be the general source for guidance on aging detection techniques. These guidance documents include field guides and aging identification and assessment checklists. These documents provide descriptions of observable indicators relative to specific aging degradation.

Examples of EPRI guidance documents are:

- EPRI TR-107668, "Guidelines for System Monitoring by System Engineers"
- EPRI TR-104514, "How to Conduct Material Condition Inspections"
- EPRI 1007933, "Aging Assessment Field Guide."

EPRI 1007933 is a field guide for assessing aging degradation. This field guide provides a description of the aging degradation and photographic images of the actual degradation. This field guide has specific indicators to identify aging degradation. For example, the polymers (including neoprene) section lists indicators for chemical, thermal, radiation, ultraviolet, etc. induced degradation. Crevice corrosion is also included under the topic of metal degradation.

Instruction to understand age-related degradation of plant SSCs and to identify the leading indicators of various degradation mechanisms and effects will be provided. EPRI guidance, supplemented by other related materials, will be used to establish this instruction. Examples of training topics are:

- Fundamentals
- Metals Aging Degradation
- Concrete Aging Degradation
- Polymers Aging Degradation
- Protective Coatings and Linings Aging Degradation
- Electrical Components Aging Degradation

Should there be indication of an unacceptable degradation, the visual inspection will be supplemented with other examine techniques or analytical evaluation as needed. For example, visual observation of crack-like-indications identified during monitoring will be reported via the corrective action process. As part of the corrective action process, further evaluation will be performed using applicable techniques such as non-destructive examination methods (e.g., dye penetrant testing), to determine the extent of degradation and needed corrective actions. This process would be used to confirm the presence of stress corrosion cracking.

In response to the specific items in this question, the following information is provided:

<u>Item a</u>

Regarding changes in material condition or cracking in elastomers, including neoprene, visual inspection will detect degradation indicators such as discoloration, surface films, wrinkling, distortion, and crack-like indications. The presence of any of these indicators will trigger an evaluation to determine the extent of degradation.

Item b

Visual inspection will identify crack-like indications that will require further evaluation via the corrective action process. Further evaluation, via NDE methods, will identify the specific type of cracking, such as stress corrosion cracking. See response to RAI 3.3.2.3-1.

Items c and d

Visual inspection will identify loss of material due to corrosion as evidenced by the presence of localized corrosion products, such as scale and metal oxides. The majority of the remaining exposed base metal will appear unaffected. Identification of the corrosion as crevice corrosion is based on locations and materials that would be susceptible to this type of corrosion because of crevice geometry (e.g., presence of crevices or crevice forming materials, bolted versus welded connections) and stagnant liquid environment. Additional guidance (from industry sources such as NACE International) will be used to identify crevice corrosion as well as other types of corrosion as appropriate. Significant surface degradation will be evaluated via the corrective action process.

Item e

Cracking due to stress corrosion cracking and loss of material due to crevice corrosion for the stainless steel spent fuel pool liner in a treated water environment is managed by the Plant Chemistry Program as stated in LRA Table 3.5.2-15 (Page 3-748). This is consistent with GALL line item III.A5.2-b...

...Additionally, Note 539 states, "The System Condition Monitoring Program is credited for monitoring the spent fuel pool water level and spent fuel pool leakage". This note was specifically added to define the consistency with GALL and to differentiate between the two AMPs with regard to what aging effect/mechanism was managed by each.

Based on its review, the staff found the applicant's response to RAI B2.1.32-2 acceptable. The applicant addressed inspection methods and acceptance criteria for various aging effects, including change in material properties for elastomers, SCC, pitting, and crevice corrosion. The methods described by the applicant are acceptable detection techniques for the aging effects addressed; therefore, the staff's concern described in RAI B2.1.32-2 is resolved.

The staff confirmed that the Detection of Aging Effects element satisfies SRP-LR Section A.1.2.3 criteria. The Detection of Aging Effects element links the Parameters Monitored or Inspected element to the aging effects managed, the System Condition Monitoring Program adequately describes data collection, and examination methods and frequency are adequately linked to plant-specific and industry operating experience. On this basis, the staff found the applicant's proposed Detection of Aging Effects program element acceptable.

(5) Monitoring and Trending—The applicant stated that the System Condition Monitoring Program is capable of detecting the effects of aging before a structure's (hangers and supports) or component's loss of function can occur. Visual inspections performed at least once per year for systems and components accessible during normal plant operation may increase in frequency based on the safety significance, production significance, or operating experience of each system. The applicant inspects systems and components accessible only during plant outages at least once per refueling interval. These inspections and walkdowns provide timely detection of aging effects (i.e., before the loss of intended function). It documents inspection and walkdown results for condition trending information.

The staff confirmed that the Monitoring and Trending element satisfies SRP-LR Section A.1.2.3 criteria. The System Condition Monitoring Program monitors and trends certain attributes like leakage and addresses the predictability of the extent of degradation and, thus, timely corrective action. On this basis, the staff found the applicant's proposed Monitoring and Trending program element acceptable.

(6) Acceptance Criteria—The applicant stated that it will use normal design standards, procedural requirements, CLB information, and industry codes or standards (e.g., EPRI, INPO) to determine acceptance criteria. Implementing instructions and procedures will include acceptance criteria for age-related degradation such as corrosion, leakage, deformation, cracking, and other adverse conditions that negatively impact performance of a license renewal intended function. The applicant will use references such as EPRI field guides for acceptance criteria guidance. It will enter excessive or abnormal conditions not meeting acceptance criteria into the corrective action process based on evaluation results.

The staff confirmed that the Acceptance Criteria element satisfies SRP-LR A.1.2.3 criteria. The Acceptance Criteria element provides a basis for evaluation of the need for corrective actions to ensure that the SC intended function will be maintained during the period of extended operation. On this basis, the staff found the applicant's Acceptance Criteria program element acceptable.

Operating Experience. The applicant stated that the System Condition Monitoring Program has been effective in monitoring system performance and, as enhanced, provides reasonable assurance of effective management of aging effects from external visible aging mechanisms. The System Condition Monitoring Program is based on routine walkdowns by qualified system engineers. The Engineering Department monitors walkdown progress monthly as a performance indicator, with a goal of 90 percent completed as scheduled. Since data gathering began in May 2003, the applicant completed 100 percent of the monthly walkdowns through August 2004 as scheduled. Numerous examples were noted where system engineers documented needed corrective actions through minor maintenance tasks, WOs, or AR (entered into the site CAP). System engineers maintain system health reports as one way to track the progress of system performance, outstanding work, and the results of their operating experience reviews. Of the 82 systems tracked by system health reports, all but three met or exceeded performance expectations as of September 2004.

The staff confirmed that the Operating Experience element satisfies SRP-LR A.1.2.3 criteria. Operating experience with the existing program shows that the System Condition Monitoring Program detects system degradation in a timely manner. On this basis, the staff found the applicant's Operating Experience program element acceptable.

The applicant credited the System Condition Monitoring Program with managing aging effects for structural components like concrete anchors and elastomers. The GALL Report recommends the Structures Monitoring Program for management of these types of components. As documented in the audit and review report, the staff asked the applicant to discuss how the System Condition Monitoring Program addresses the GALL Report recommendations for the Structures Monitoring Program for managing aging effects of these components. The applicant stated that it reassigned a number of components to be managed by the Structures Monitoring Program as recommended by the GALL Report to the System Condition Monitoring Program. For these components, the 10 attributes of both AMPs are compatible in that they address similar scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, and administrative controls elements. On the basis of its review and the information provided by the applicant, the staff found that the System Condition Monitoring Program provides acceptable aging management for these structural components.

USAR Supplement. In LRA Section A2.1.32, the applicant provided the USAR supplement for the System Condition Monitoring Program. The staff reviewed this section and determined that the information in the USAR supplement adequately describes the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's System Condition Monitoring Program, the staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it adequately describes the program, as required by 10 CFR 54.21(d).

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

Pursuant to 10 CFR 54.21(a)(3), a license renewal applicant must demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation.

Branch Technical Position IQMB-1, "Quality Assurance For Aging Management Programs," (SRP-LR Section A.2) provides the following guidance with regard to the QA attributes of AMPs:

- SR SCs are subject to the requirements of Appendix B to 10 CFR Part 50, which are adequate to address all quality-related aspects of an AMP consistent with the CLB of the facility for the period of extended operation.
- For NSR SCs that are subject to an AMR, an applicant has an option to expand the scope of its program for Appendix B to 10 CFR Part 50 to include these SCs to address corrective actions, the confirmation process, and administrative controls for aging

management during the period of extended operation. In this case, the applicant should document such a commitment in the USAR supplement in accordance with 10 CFR 54.21(d).

3.0.4.1 Summary of Technical Information in the Application

LRA Section A2, "Programs That Manage the Effects of Aging," states that the elements of Corrective Actions, Confirmation Process, and Administrative Controls in the Quality Assurance Program apply to both SR and NSR SSCs subject to an AMR. In LRA Section B1.3, "Quality Assurance Program and Administrative Controls," the applicant described the quality attributes of the plant-specific AMPs and summarized them as follows:

- A single corrective actions process is applied regardless of the safety classification of the SC. Corrective actions are implemented through the initiation of an AR in accordance with plant procedures established in response to Appendix B to 10 CFR Part 50.
- The programs correct equipment deficiencies through the initiation of a WO in accordance with plant procedures. Although a WO may initially document equipment deficiencies, the corrective action process specifies that an AR also be initiated for actual or potential problems, including failures, malfunctions, discrepancies, deviations, defective material and equipment, nonconformances, and administrative control discrepancies. Site-specific administrative work instructions will apply to both SR and NSR SCs that are subject to an AMR consistent with the CLB during the period of extended operation.
- The confirmation process is part of the CAP. The confirmation process focuses on the followup actions that must be taken to verify effective implementation of corrective actions. Effectiveness is measured in terms of correcting the adverse condition and precluding repetition of significant conditions adverse to quality. Plant procedures include provisions for timely evaluation of adverse conditions and implementation of any corrective actions required, including root cause determinations and prevention of recurrence where appropriate (e.g., significant conditions adverse to quality). These procedures provide for tracking, coordinating, monitoring, reviewing, verifying, validating, and approving corrective actions to ensure that effective corrective actions are taken. The AR process is also monitored for potentially adverse trends. The existence of an adverse trend because of recurring or repetitive adverse conditions will result in the initiation of an AR. The AMAs required for license renewal will also uncover any unsatisfactory condition resulting from ineffective corrective action. The applicant will enhance site documents that implement AMAs for license renewal to ensure that an AR is prepared in accordance with plant procedures whenever nonconforming conditions are found (i.e., the acceptance criteria are not met).
- The document control process applies to all MNGP documents, procedures, and instructions regardless of safety classification of the associated SC. The applicant implements the document control processes in accordance with the requirements of Appendix B to 10 CFR Part 50. The document control requirements will apply to AMPs.

In its letter dated June 10, 2005, the applicant revised Appendix A to its LRA to add Section A.5, which contains a commitment list related to license renewal aging management that will be added to the USAR following receipt of the extended license.

3.0.4.2 Staff Evaluation

The staff reviewed portions of the applicant's AMPs described in LRA Sections A2, A5, and B1.3 to ensure that the AMAs are consistent with the staff's guidance in Branch Technical Position IQMB-1 regarding AMP QA attributes. The staff confirmed that the descriptions, commitments, and applicability of the plant-specific AMPs and their associated quality attributes provided in LRA Sections A2, A5, and B1.3 are consistent with the staff position in Branch Technical Position IQMB-1 regarding aging management QA.

3.0.4.3 Conclusion

The applicant described the quality attributes of the programs and activities for managing the effects of aging for both SR and NSR SSCs within the scope of license renewal. The staff found that the QA attributes of the applicant's AMPs as described in LRA Sections A2, A5, and B1.3 are consistent with the staff position in Branch Technical Position IQMB-1. Therefore, the QA attributes of the applicant's AMPs appropriately ensure adequate management of aging effects to maintain intended functions consistent with the CLB in accordance with 10 CFR 54.21(a)(3). The staff also found the commitment in the applicant's letter dated June 10, 2005, to revise the USAR to specify commitments related to license renewal aging management consistent with Branch Technical Position IQMB-1. Therefore, it meets the requirement in 10 CFR 54.21(d).

3.1 Aging Management of Reactor Coolant System

This section of the SER documents the staff's review of the applicant's AMR results for the RCS components and component groups associated with the following systems:

- reactor head vent system
- reactor pressure vessel
- reactor pressure vessel internals
- reactor recirculation system
- reactor vessel instrumentation

3.1.1 Summary of Technical Information in the Application

In LRA Section 3.1, the applicant provided AMR results for the RCS components and component groups. In LRA Table 3.1.1, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the reactor vessel, internals, and RCS components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a

review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the RCS components that are within the scope of license renewal and subject to an AMR will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In addition, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs are consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant had identified the appropriate GALL Report AMRs. SER Section 3.0.3 documents the staff's evaluations of the AMPs. The MNGP audit and review report details the staff's audit evaluation, which is summarized in SER Section 3.1.2.1.

The staff also performed an onsite audit of those selected AMRs that are consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the acceptance criteria in Section 3.1.2.2 of the SRP-LR. The MNGP audit and review report documents the staff's audit evaluations, which are summarized in SER Section 3.1.2.2.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that are not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether the applicant identified all plausible aging effects and whether the aging effects listed are appropriate for the combination of materials and environments specified. The MNGP audit and review report documents the staff's audit evaluations. SER Section 3.1.2.3 documents the staff's audit evaluations and technical review.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the RCS components.

Table 3.1-1 below summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.1, that are addressed in the GALL Report.

Table 3.1-1 Staff Evaluation for Reactor Coolant System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor coolant pressure boundary components (Item Number 3.1.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components
Steam generator shell assembly (Item Number 3.1.1-02)	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry		Not applicable, PWR only
Isolation condenser (Item Number 3.1.1-03)	Loss of material due to general, pitting, and crevice corrosion	Inservice inspection; water chemistry		Not applicable (see Section 3.1.2.2.2)
Pressure vessel ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 (E > 1 MeV) (Item Number 3.1.1-04)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G to 10 CFR 50 and RG 1.99	TLAA	This TLAA is evaluated in Section 4.2, Neutron Embrittlement of the Reactor Pressure Vessel and Internals
Reactor vessel beltline shell and welds (Item Number 3.1.1-05)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Reactor Vessel Surveillance Program (B2.1.29)	Consistent with GALL, which recommends further evaluation (see Section 3.1.2.2.3)
Westinghouse and B&W baffle/former bolts (Item Number 3.1.1-06)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant specific		Not applicable, PWR only
Small-bore reactor coolant system and connected systems piping (Item Number 3.1.1-07)	Crack initiation and growth due to SCC, intergranular SCC, and thermal and mechanical loading	Inservice inspection; water chemistry, one-time inspection	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2); One-Time Inspection Program (B2.1.23); Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (see Section 3.1.2.2.4)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Jet pump sensing line, and reactor vessel flange leak detection line (Item Number 3.1.1-08)	Crack initiation and growth due to SCC, intergranular stress corrosion cracking (IGSCC), or cyclic loading	Plant specific	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2); One-Time Inspection Program (B2.1.23); Plant Chemistry Program (B2.1.25)	The jet pump sensing lines internal to the reactor vessel are outside the scope of license renewal. The vessel flange leak detection line is covered by Item Number 3.1.1-07. Further evaluation in Section 3.1.2.2.4
Isolation condenser (Item Number 3.1.1-09)	Crack initiation and growth due to stress corrosion cracking (SCC) or cyclic loading	Inservice inspection; water chemistry		Not applicable (see Section 3.1.2.2.4)
Vessel shell (Item Number 3.1.1-10)	Crack growth due to cyclic loading	TLAA		Not applicable, PWR only
Reactor internals (Item Number 3.1.1-11)	Changes in dimension due to void swelling	Plant specific		Not applicable, PWR only
PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains (Item Number 3.1.1-12)	Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC)	Plant specific		Not applicable, PWR only
Cast austenitic stainless steel (CASS) reactor coolant system piping (Item Number 3.1.1-13)	Crack initiation and growth due to SCC	Plant specific		Not applicable, PWR only
Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys (Item Number 3.1.1-14)	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry		Not applicable, PWR only

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Westinghouse and B&W baffle former bolts (Item Number 3.1.1-15)	Crack initiation and growth due to SCC and IASCC	Plant specific		Not applicable, PWR only
Westinghouse and B&W baffle former bolts (Item Number 3.1.1-16)	Loss of preload due to stress relaxation	Plant specific		Not applicable, PWR only
Steam generator feedwater impingement plate and support (Item Number 3.1.1-17)	Loss of section thickness due to erosion	Plant specific		Not applicable, PWR only
(Alloy 600) steam generator tubes, repair sleeves, and plugs (Item Number 3.1.1-18)	Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), and/or intergranular attack (IGA) or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections	Steam generator tubing integrity; water chemistry		Not applicable, PWR only
Tube support lattice bars made of carbon steel (Item Number 3.1.1-19)	Loss of section thickness due to FAC	Plant specific		Not applicable, PWR only
Carbon steel tube support plate (Item Number 3.1.1-20)	Ligament cracking due to corrosion	Plant specific		Not applicable, PWR only
Steam generator feedwater inlet ring and supports (Item Number 3.1.1-21)	Loss of material due to flow-corrosion	Combustion engineering (CE) steam generator feedwater ring inspection		Not applicable, PWR only
Reactor vessel closure studs and stud assembly (Item Number 3.1.1-22)	Crack initiation and growth due to SCC and/or IGSCC	Reactor head closure studs	Reactor Head Closure Studs Program (B2.1.28)	Consistent with GALL Report, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
CASS pump casing and valve body (Item Number 3.1.1-23)	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)	Consistent with GALL Report (see Section 3.1.2.1.1)
CASS piping (Item Number 3.1.1-24)	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS		Not applicable, MNGP does not have CASS piping
BWR piping and fittings; steam generator components (Item Number 3.1.1-25)	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion	Flow-Accelerated Corrosion Program (B2.1.19)	Consistent with GALL Report for BWR piping and fittings in the RCS. MNGP is a BWR and does not have a steam generator
Reactor coolant pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high pressure and high-temperature systems (Item Number 3.1.1-26)	Loss of material due to wear, loss of preload due to stress relaxation, crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting Integrity Program (B2.1.4)	Consistent with GALL Report, which recommends no further evaluation
Feedwater and control rod drive (CRD) return line nozzles (Item Number 3.1.1-27)	Crack initiation and growth due to cyclic loading	Feedwater nozzle, CRD return line nozzle	BWR Control Rod Drive Return Line Nozzle Program (B2.1.7), BWR Feedwater Nozzle Program (B2.1.8)	Consistent with GALL Report, which recommends no further evaluation
Vessel shell attachment welds (Item Number 3.1.1-28)	Crack initiation and growth due to SCC, IGSCC	BWR vessel ID attachment welds, water chemistry	BWR Vessel ID Attachment Welds Program (B2.1.11), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Nozzle safe ends, recirculation pump casing, connected systems piping and fittings, body and bonnet of valves (Item Number 3.1.1-29)	Crack initiation and growth due to SCC, IGSCC	BWR stress corrosion cracking; water chemistry	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2); BWR Stress Corrosion Cracking Program (B2.1.10); One-Time Inspection Program (B2.1.23); Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Penetrations (Item Number 3.1.1-30)	Crack initiation and growth due to SCC, IGSCC, cyclic loading	BWR penetrations, water chemistry	BWR Penetrations Program (B2.1.9), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Core shroud and core plate, support structure, top guide, core spray lines and spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes (Item Number 3.1.1-31)	Crack initiation and growth due to SCC, IGSCC, IASCC	BWR vessel internals, water chemistry	BWR Vessel Internals Program (B2.1.12), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Core shroud and core plate access hole cover (welded and mechanical covers) (Item Number 3.1.1-32)	Crack initiation and growth due to SCC, IGSCC, IASCC	ASME Section XI inservice inspection; water chemistry	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2); Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Jet pump assembly castings, orificed fuel support (Item Number 3.1.1-33)	Loss of fracture toughness due to thermal aging and neutron embrittlement	Thermal aging and neutron irradiation embrittlement	Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B2.1.33)	Consistent with GALL Report, which recommends no further evaluation
Unclad top head and nozzles (Item Number 3.1.1-34)	Loss of material due to general, pitting, and crevice corrosion	Inservice inspection; water chemistry		Not applicable. The top head enclosure is clad at MNGP
CRD nozzle (Item Number 3.1.1-35)	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations, water chemistry		Not applicable, PWR only

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor vessel nozzles safe ends and CRD housing, reactor coolant system components (except CASS and bolting) (Item Number 3.1.1-36)	Crack initiation and growth due to cyclic loading, and/or SCC and PWSCC	Inservice inspection; water chemistry		Not applicable, PWR only
Reactor vessel internals CASS components (Item Number 3.1.1-37)	Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement, and void swelling	Thermal aging and neutron irradiation embrittlement		Not applicable, PWR only
External surfaces of carbon steel components in reactor coolant system pressure boundary (Item Number 3.1.1-38)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable, PWR only
Steam generator secondary manways and handholds (CS) (Item Number 3.1.1-39)	Loss of material due to erosion	Inservice inspection		Not applicable, PWR only
Reactor internals, reactor vessel closure studs, and core support pads (Item Number 3.1.1-40)	Loss of material due to wear	Inservice inspection		Not applicable, PWR only
Pressurizer integral support (Item Number 3.1.1-41)	Crack initiation and growth due to cyclic loading	Inservice inspection		Not applicable, PWR only
Upper and lower internals assembly (Westinghouse) (Item Number 3.1.1-42)	Loss of preload due to stress relaxation	Inservice inspection; loose part and/or neutron noise monitoring		Not applicable, PWR only
Reactor vessel internals in fuel zone region (except Westinghouse and B&W baffle bolts) (Item Number 3.1.1-43)	Loss of fracture toughness due to neutron irradiation embrittlement, and void swelling	PWR vessel internals, water chemistry		Not applicable, PWR only

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steam generator upper and lower heads, tubesheets, primary nozzles and safe ends (Item Number 3.1.1-44)	Crack initiation and growth due to SCC, PWSCC, IASCC	Inservice inspection; water chemistry		Not applicable, PWR only
Vessel internals (except Westinghouse and B&W baffle former bolts) (Item Number 3.1.1-45)	Crack initiation and growth due to SCC and IASCC	PWR vessel internals, water chemistry		Not applicable, PWR only
Reactor internals (B&W screws and bolts) (Item Number 3.1.1-46)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring		Not applicable, PWR only
Reactor vessel closure studs and stud assembly (Item Number 3.1.1-47)	Loss of material due to wear	Reactor head closure studs		Not applicable, PWR only
Reactor internals (Westinghouse upper and lower internal assemblies; CE bolts and tie rods) (Item Number 3.1.1-48)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring		Not applicable, PWR only

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in SER Section 3.1.2.1, involves the staff's review of the AMR results for components in the RCS that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in SER Section 3.1.2.2, involves the staff's review of the AMR results for components in the RCS that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.1.2.3, involves the staff's review of the AMR results for components in the RCS that the applicant indicated are not consistent with, or not addressed in, the GALL Report. SER Section 3.0.3 documents the staff's review of AMPs that are credited to manage or monitor aging effects of the RCS components.

3.1.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.1.2.1, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the RCS components:

- ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)
- Bolting Integrity Program (B2.1.4)
- BWR Control Rod Drive Return Line Nozzle Program (B2.1.7)
- BWR Feedwater Nozzle Program (B2.1.8)
- BWR Penetrations Program (B2.1.9)
- BWR Stress Corrosion Cracking Program (B2.1.10)
- BWR Vessel ID Attachment Welds Program (B2.1.11)
- BWR Vessel Internals Program (B2.1.12)
- Closed-Cycle Cooling Water System Program (B2.1.13)
- Flow-Accelerated Corrosion Program (B2.1.19)
- One-Time Inspection Program (B2.1.23)
- Plant Chemistry Program (B2.1.25)
- Reactor Head Closure Studs Program (B2.1.28)
- Reactor Vessel Surveillance Program (B2.1.29)
- System Condition Monitoring Program (B2.1.32)
- Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B2.1.33)

Staff Evaluation. In LRA Tables 3.1.2-1 through 3.1.2-5, the applicant provided a summary of AMRs for the RCS components, and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the GALL Report evaluation bounds the plant-specific components contained in these GALL Report component groups.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component is applicable to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component is applicable to the component under review. The staff verified that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but the applicant credited a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP will manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs. The following sections discuss the staff's evaluation.

3.1.2.1.1 Loss of Fracture Toughness Due to Thermal Aging Embrittlement

<u>NRC Audit Item 3.1-18</u>

In the discussion section of LRA Table 3.1.1, Item Number 3.1.1-23, the applicant stated the following:

> This line item is not used at MNGP. The reactor coolant systems components of CASS material are portions of the Jet Pump, Fuel Support, and CRD assemblies. See items 3.1.1-31 and 3.1.1-33 for these components. In addition, CASS valve bodies in the ESF system are discussed in item 3.2.1-11 of Table 3.2.1.

During the audit and review, the staff noted that the LRA states that, "This line item is not used at MNGP." Based on the LRA discussion in Table 3.1.1, Item 3.1.1-23, the staff reviewed ESF Item Number 3.2.1-11 in LRA Table 3.2.1 for CASS piping and fittings in the ECCS. The staff confirmed that the LRA includes AMR results for CASS valve bodies in the CSP system (LRA Table 3.2.2-3) and in the RHR system (LRA Table 3.2.2-7), which the applicant had referenced appropriately to GALL Report line IV.C1.3-b. The staff also confirmed that the material, environment, aging effect, and AMP combination specified in the LRA for these valves is consistent with GALL Report line IV.C1.3-b, which applies to CASS valves in a reactor coolant water environment with an aging effect of loss of fracture toughness due to thermal aging embrittlement and which specifies the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program as the AMP for Class 1 components. However, the staff noted that the applicant had linked these AMR results with Item 3.1.1-23 in LRA Table 3.1.1, where the discussion states that, "This line item is not used at MNGP."

Therefore, the staff asked that the applicant resolve the LRA discrepancy linking AMR results for components in one table with an item number in another table, while stating that MNGP does not use the item number. In its response, dated August 11, 2005, the applicant stated the following:

> LRA Table 3.1.1, Item Number 3.1.1-23, should be revised to read, 'CASS components in the ESF systems subject to an environment that supports loss of fracture toughness due to thermal aging embrittlement were assigned to the ASME Section XI In-Service Inspection, Subsections IWB, IWC and IWD Program. Those CASS components that are subject to this aging effect/ mechanism are valves.'

Based on its review, the staff found the applicant's response to NRC Audit Item 3.1-18 acceptable because the components, material, aging effect, and AMP identified in the LRA are consistent with the GALL Report. The staff found that the applicant had appropriately addressed the aging management for these components. SER Section 3.0.3.2.2 documents the staff's evaluation of the applicant's ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program.

On the basis of its review, the staff found that the applicant addressed the aging effects and mechanisms as identified in the GALL Report.

<u>Conclusion</u>. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff concluded that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report; therefore, the staff concluded that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application. In LRA Section 3.1.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the RCS components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to pitting and crevice corrosion
- loss of fracture toughness due to neutron irradiation embrittlement
- crack initiation and growth due to thermal and mechanical loading or stress corrosion cracking
- crack growth due to cyclic loading
- changes in dimension due to void swelling
- crack initiation and growth due to stress corrosion cracking or primary water stress corrosion cracking
- crack initiation and growth due to stress corrosion cracking or irradiation-assisted stress corrosion cracking
- loss of preload due to stress relaxation
- loss of section thickness due to erosion
- crack initiation and growth due to PWSCC, ODSCC, or intergranular attack or loss of material due to wastage and pitting corrosion or loss of section thickness due to fretting and wear or denting due to corrosion of carbon steel tube support plate
- loss of section thickness due to flow-accelerated corrosion
- ligament cracking due to corrosion
- loss of material due to flow-accelerated corrosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.1.2.2 of the SRP-LR. The staff's audit and review report details the staff's audit. The following sections discuss the staff's evaluation of the aging effects.

3.1.2.2.1 *Cumulative Fatigue Damage*

In LRA Section 3.1.2.2.1, the applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3, "Definitions." Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.1.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Sections 3.1.2.2.2.1 and 3.1.2.2.2.2 against SRP-LR Section 3.1.2.2.2 criteria.

In LRA Section 3.1.2.2.2.1, the applicant addressed loss of material due to pitting and crevice corrosion in the steel pressurized-water reactor (PWR) steam generator shell assembly.

Loss of material for a steam generator shell assembly applies to PWRs only. The staff found this aging effect not applicable.

In LRA Section 3.1.2.2.2.2, the applicant addressed loss of material due to pitting and crevice corrosion in BWR isolation condenser components.

MNGP has no isolation condenser. The staff found this aging effect not applicable.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

The staff reviewed LRA Sections 3.1.2.2.3.1 through 3.1.2.2.3.3 against SRP-LR Section 3.1.2.2.3 criteria.

In LRA Section 3.1.2.2.3.1, the applicant addressed loss of fracture toughness due to neutron irradiation embrittlement for pressure vessel ferritic materials with a neutron fluence greater than 10^{17} n/cm^2. The applicant stated that neutron irradiation embrittlement is a TLAA as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). LRA Section 4.2 describes the applicant's evaluation of this TLAA.

In LRA Section 3.1.2.2.3.2, the applicant addressed loss of fracture toughness due to neutron irradiation embrittlement for the reactor vessel, stating that the Reactor Vessel Surveillance Program, described in LRA Section B2.1.29, manages loss of fracture toughness due to neutron irradiation embrittlement for the reactor vessel. SER Section 3.0.3.2.21 documents the staff's review of the Reactor Vessel Surveillance Program.

SRP-LR Section 3.1.2.2.3 states that certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3 and that TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). SER Section 4.2 documents the staff's review of the applicant's evaluation of this TLAA. SRP-LR Section 3.1.2.2.3 also states that for loss of fracture toughness due to neutron embrittlement of the reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux, a reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel.

Appendix H to 10 CFR Part 50 requires the applicant's Reactor Vessel Surveillance Program. BWRVIP ISP guidance describes the scope of the Reactor Vessel Surveillance Program. BWRVIP-86-A includes the ISP capsule removal schedule, and BWRVIP-78 describes its technical basis. The NRC approved the ISP in an SE to the BWRVIP, dated February 1, 2002, concluding that, if implemented in accordance with the conditions in the SE, the ISP is an acceptable alternative to all existing BWR plant-specific RPV surveillance programs for maintaining compliance with the requirements of Appendix H to 10 CFR Part 50 through the end of the current facility 40-year operating license period.

BWRVIP-116 incorporates the technical criteria specified in BWRVIP-78 and BWRVIP-86 and extends the ISP to cover the BWR fleet through an extended period of operation. The applicant committed to implement the requirements of BWRVIP-116, when approved.

In LRA Section 3.1.2.2.3.3, the applicant addressed loss of fracture toughness due to neutron irradiation embrittlement in Westinghouse and Babcock and Wilcox (B&W) baffle/former bolts. This section applies to PWRs only. The staff found this aging effect not applicable.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.1.2.2.3. For those line items that apply to LRA Sections 3.1.2.2.3.1 through 3.1.2.2.3.3, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.4 Crack Initiation and Growth Due to Thermal and Mechanical Loading or Stress-Corrosion Cracking

The staff reviewed LRA Sections 3.1.2.2.4.1 through 3.1.2.2.4.3 against SRP-LR Section 3.1.2.2.4 criteria.

In LRA Section 3.1.2.2.4.1, the applicant addressed crack initiation and growth due to thermal and mechanical loading or SCC in small-bore RCS and connected system piping less than 4-inch nominal pipe size (NPS). The applicant stated that the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, together with the Plant Chemistry Program and One-Time Inspection Program manage the aging effect. The applicant further stated that the ASME Code, Section XI, does not require volumetric examination of pipes less than 4-inch NPS and that the scope of the One-Time Inspection Program validates AMP effectiveness by verifying unacceptable degradation. The applicant stated that the aging effects monitored/inspected by its One-Time Inspection Program include crack initiation and growth and that this program includes one-time inspections to monitor a component's degradation using a variety of NDE methods.

SRP-LR Section 3.1.2.2.4, item 1, states the following:

> Crack initiation and growth due to thermal and mechanical loading or SCC (including intergranular stress corrosion cracking [IGSCC]) could occur in small-bore reactor coolant system and connected system piping less than NPS 4. The existing program relies on ASME Section XI ISI and on control of water chemistry to mitigate SCC. The GALL report recommends that a plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the extended period. The AMPs should be augmented by verifying that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. A one-time inspection of a sample of locations is an acceptable method to ensure that the aging effect is not occurring and the component's intended function will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.1.2.2.4.1, Tables 3.1.2-1 through 3.1.2-5, and LRA Appendix B2.1.23, and confirmed that the applicant's One-Time Inspection Program appropriately includes the small bore, Class 1 piping in the head vent system and the reactor vessel instrumentation system.

The staff also reviewed the applicant's drawings of the RCS and connected systems and identified a number of small-bore, Class 1 pipe segments. The staff asked the applicant whether the One-Time Inspection Program includes each of the segments. In its response, by letter dated August 11, 2005, the applicant provided additional information including references to LRA table entries. The staff reviewed the applicant's response and concluded that the applicant's One-Time Inspection Program appropriately includes all Class 1 small-bore pipe segments.

As part of its response, the applicant stated that in Class 1, small-bore stainless steel piping, the aging effect managed by the Plant Chemistry and One-Time Inspection Programs is cracking due to SCC; however, in Class 1, small-bore carbon steel piping, the aging effect managed by the Plant Chemistry and One-Time Inspection Programs is loss of material due to corrosion. Because different examination techniques are typically required to detect the aging effect of cracking versus that of loss of material, the staff asked the applicant to justify why it does not manage the Class 1, small-bore carbon steel piping for an aging effect of crack initiation and growth due to thermal and mechanical loading.

In its response dated August 11, 2005, the applicant stated that it had performed an analytical evaluation to classify all Class 1 and 2 piping welds by failure potential based on methodology in EPRI TR-112657, Revision B-A. Based on this evaluation, the applicant determined that it has no Class 1, small-bore carbon steel piping in an environment where cracking due to mechanical or thermal loading will occur. Consequently, one-time inspection of Class 1, small-bore carbon steel piping will focus on the loss of material, but not on the crack initiation and growth aging effect.

The staff reviewed the applicant's response together with the applicant's calculation providing the analytical basis for excluding cracking as an aging effect in Class 1, small-bore carbon steel piping. The staff noted that SRP-LR Section 3.1.2.2.4 makes no distinction between stainless steel and carbon steel piping, and that the purpose of the one-time inspection is to validate the absence of cracks that the ASME Code, Section XI, examinations required for small-bore piping might not detect. Because the applicant used an appropriate methodology to exclude the aging effect of cracking in carbon steel small-bore piping and will perform a one-time inspection for cracking in stainless steel small-bore piping, the staff found the applicant's programs for managing aging effects in Class 1, small-bore piping acceptable. SER Sections 3.0.3.2.2, 3.0.3.2.19, and 3.0.3.1.4 document the staff's evaluations of the applicant's ASME Section XI, In-Service Inspection, Subsections IWB, IWC, and IWD Program, Plant Chemistry Program, and One-Time Inspection Program, respectively.

On the basis of its review, the staff concluded that the applicant has met the SRP-LR Section 3.1.2.2.4.1 criteria for further evaluation. For those line items that apply to LRA Section 3.1.2.2.4.1, the staff found that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation as required by 10 CFR 54.21(a)(3).

In LRA Section 3.1.2.2.4.2, the applicant addressed crack initiation and growth due to thermal and mechanical loading or SCC in reactor vessel flange leak detection lines and jet pump sensing lines.

SRP-LR Section 3.1.2.2.4, item 2, states the following:

> *Crack initiation and growth due to thermal and mechanical loading or SCC (including IGSCC) could occur in BWR reactor vessel flange leak detection line and BWR jet pump sensing line. The GALL report recommends that a plant specific aging management program be evaluated to mitigate or detect crack initiation and growth due to SCC of vessel flange leak detection line.*

In LRA Section 3.1.2.2.4.2, the applicant stated that the jet pump sensing lines internal to the reactor vessel are not within the scope of license renewal, referring to the LRA's "Further Evaluation" description of crack initiation and growth due to thermal and mechanical loading or SCC regarding management of the reactor vessel flange leak detection line and other small-bore RCS and connected system piping.

The staff noted that the jet pump sensing lines external to the vessel are small-bore piping and included in LRA Table 3.1.2-5 as piping and fittings made of stainless steel in a treated water environment with an aging effect of cracking due to SCC/IGA. For this component, material, environment, and aging effect, the LRA stated that the applicable AMPs are the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, the One-Time Inspection Program, and the Plant Chemistry Program. This is consistent with the GALL Report recommendation for small-bore, stainless steel pipe in a reactor coolant water environment. Based on consistency with the GALL Report recommendations, the staff found the applicant's AMPs for these components acceptable as consistent with the GALL Report recommendations.

For aging management of the reactor vessel flange leak detection line, the applicant, in LRA Section 3.1.2.2.4.2, stated that the aging effects/mechanisms for this component are the same as for other small-bore RCS and connected system piping. For these components, the applicable AMPs are the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program together with the Plant Chemistry Program and the One-Time Inspection Program. As the reactor vessel flange leak detection line has the same material and environment and, consequently, the same aging effects as Class 1 small-bore piping, the staff concluded that the AMPs that the applicant identified for this component are acceptable. SER Sections 3.0.3.2.2, 3.0.3.2.19, and 3.0.3.1.4 document the staff reviews and evaluations of the applicant's ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, Plant Chemistry Program, and One-Time Inspection Program, respectively.

On the basis of its review, the staff concluded that the applicant has met SRP-LR Section 3.1.2.2.4.2 criteria for further evaluation. For those line items that apply to LRA Section 3.1.2.2.4.2, the staff found that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation as required by 10 CFR 54.21(a)(3).

In LRA Section 3.1.2.2.4.3, the applicant addressed crack initiation and growth due to thermal and mechanical loading or SCC in the BWR isolation condenser. Because there is no isolation condenser, the staff found this aging effect not applicable.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.5 against SRP-LR Section 3.1.2.2.5 criteria.

In LRA Section 3.1.2.2.5, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.5 states that crack growth due to cyclic loading could occur in the reactor vessel shell and the RCS piping and fittings. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.6 Changes in Dimension Due to Void Swelling

The staff reviewed LRA Section 3.1.2.2.6 against SRP-LR Section 3.1.2.2.6 criteria.

In LRA Section 3.1.2.2.6, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.6 states that changes in dimension due to void swelling could occur in reactor internal components. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.7 Crack Initiation and Growth Due to Stress-Corrosion Cracking or Primary Water Stress-Corrosion Cracking

The staff reviewed LRA Sections 3.1.2.2.7.1 through 3.1.2.2.7.3 against SRP-LR Section 3.1.2.2.7 criteria.

In LRA Sections 3.1.2.2.7.1 through 3.1.2.2.7.3, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.7 states that crack initiation and growth due to SCC and PWSCC could occur (1) in PWR core support pads (or core guide lugs), instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains, (2) in PWR CASS RCS piping and fittings and pressurizer surge line nozzles, and (3) in PWR pressurizer instrumentation penetrations and heater sheaths and sleeves made of nickel alloys. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.8 Crack Initiation and Growth Due to Stress-Corrosion Cracking or Irradiation-Assisted Stress-Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.8 against SRP-LR Section 3.1.2.2.8 criteria.

In LRA Section 3.1.2.2.8, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.8 states that crack initiation and growth due to SCC or IASCC could occur in baffle/former bolts in Westinghouse and B&W reactors. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

The staff reviewed LRA Section 3.1.2.2.9 against SRP-LR Section 3.1.2.2.9 criteria.

In LRA Section 3.1.2.2.9, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.9 states that loss of preload due to stress relaxation could occur in baffle/former bolts in Westinghouse and B&W reactors. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.10 Loss of Section Thickness Due to Erosion

The staff reviewed LRA Section 3.1.2.2.10 against SRP-LR Section 3.1.2.2.10 criteria.

In LRA Section 3.1.2.2.10, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.10 states that loss of section thickness due to erosion could occur in steam generator FW impingement plates and supports. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.11 Crack Initiation and Growth Due to Primary Water Stress-Corrosion Cracking, Outside-Diameter Stress-Corrosion Cracking, or Intergranular Attack or Loss of Material Due to Wastage and Pitting Corrosion or Loss of Section Thickness Due to Fretting and Wear or Denting Due to Corrosion of Carbon Steel Tube Support Plate

The staff reviewed LRA Section 3.1.2.2.11 against SRP-LR Section 3.1.2.2.11 criteria.

In LRA Section 3.1.2.2.11, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.11 states that crack initiation and growth due to PWSCC, ODSCC, or IGA or loss of material due to wastage and pitting corrosion or deformation due to corrosion could occur in Alloy 600 components of the steam generator tubes, repair sleeves, and plugs. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.12 Loss of Section Thickness Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.12 against SRP-LR Section 3.1.2.2.12 criteria.

In LRA Section 3.1.2.2.12, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.12 states that loss of section thickness due to FAC could occur in tube support lattice bars made of carbon steel. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.13 Ligament Cracking Due to Corrosion

The staff reviewed LRA Section 3.1.2.2.13 against SRP-LR Section 3.1.2.2.13 criteria.

In LRA Section 3.1.2.2.13, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.13 states that ligament cracking due to corrosion could occur in carbon steel components in the steam generator tube support plate. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.1.2.2.14 Loss of Material Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.14 against SRP-LR Section 3.1.2.2.14 criteria.

In LRA Section 3.1.2.2.14, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.14 states that loss of material due to FAC could occur in FW inlet ring and supports. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that the applicant adequately addressed the applicable issues that were further evaluated. The staff found that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.1.2-1 through 3.1.2-5, the staff reviewed additional details of the results of the AMRs for material, environment, AERM, and AMP combinations that are not consistent with the GALL Report, or that are not addressed in the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-5, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report, and provided information concerning the management of the aging effect. Specifically, Note F indicates that the GALL Report does not evaluate the material for the AMR line item component. Note G indicates that the GALL Report does not evaluate the environment for the AMR line item component and material. Note H indicates that the GALL Report does not evaluate the aging effect for the AMR line item component, material, and environment combination. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination does not apply. Note J indicates that the GALL Report does not evaluate either the component or the material and environment combination for the line item.

Staff Evaluation. For component type, material, and environment combinations that the GALL Report does not evaluate, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The following sections discuss line items that are not consistent with the GALL Report or not addressed in the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-5, the applicant identified AMR line items for which it had not identified any aging effects as a result of the aging review process. Specifically, the applicant stated that no aging effects occurred when components fabricated from stainless steel material were exposed to a primary containment air or plant indoor air environment, or when components fabricated from stainless steel or carbon steel were exposed to a lubricating oil internal environment. The applicant stated that a material science evaluation for these materials in these environments discovered no aging effects.

Because stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as stated in the *Metals Handbook*, Ninth Edition, American Society for Metals International, the staff accepted the position that stainless steel in an indoor, uncontrolled air environment (e.g., plant indoor air) or in a gas environment (e.g., primary containment air inerted with nitrogen) exhibits no aging effect and that the SC will therefore remain capable of performing intended functions consistent with the CLB for the period of extended operation. Because both oxygen and moisture must be present to corrode steel, also stated in the *Metals Handbook*, Ninth Edition, the staff likewise accepted the position that steel (carbon or stainless) in a lubricating oil internal environment with no water pooling exhibits no aging effect and that the SC will therefore remain capable of performing intended functions consistent with the CLB for the period of extended operation.

On the basis of its review of current industry research and operating experience, the staff found that plant indoor air or primary containment air on stainless steel, or lubricating oil on stainless steel or carbon steel, will not cause aging of concern during the period of extended operation;

therefore, the staff concluded that no AERMs apply to the component, material, and environment described in the preceding discussion.

3.1.2.3.1 Reactor Coolant System – Reactor Head Vent System – Summary of Aging Management Evaluation – Table 3.1.2-1

The staff reviewed LRA Table 3.1.2-1, which summarizes the results of AMR evaluations for the reactor head vent system component groups.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the applicant had demonstrated that the effects of aging will be adequately managed so intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.2 Reactor Coolant System—Reactor Pressure Vessel—Summary of Aging Management Evaluation—Table 3.1.2-2

The staff reviewed LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the RPV component groups.

In LRA Table 3.1.2-2, the applicant stated that the aging effect of cumulative fatigue damage of Type 316NG stainless steel materials for the component type of nozzle safe end/CRDRL cap exposed to a reactor coolant water environment does not apply and no AMP is specified. The LRA assigns Note I to this item, indicating that the aging effect in the GALL Report for this component, material, and environment combination does not apply. An additional note in the LRA states that the CRD hydraulic return nozzle was capped with a 4-inch diameter pipe cap in 1977, that the CRD return nozzle weld butter was removed and the weld preparation reclad with chromium carbide to improve resistance to IGSCC, and that a new nozzle cap was installed in 1986. LRA Table 3.1.2-2 also states that the aging effect of crack initiation and growth due to SCC or IGSCC also applies to this component, and that the BWR SCC Program (AMP B2.1.10) and the Plant Chemistry Program (AMP B2.1.25) manage the aging effect.

The staff noted that the applicant's evaluation of this component refers to GALL Report, Volume 2, Item IV.A1.4-b, which is the CRDRL nozzle safe end. The GALL Report line item is based on an inservice CRDRL safe end that will routinely experience cyclic flow, not one effectively out of service by removal of the previously attached pipe and installation of a cap on the safe end. Capping the CRDRL safe end eliminated the cyclic flow environment to which the safe end had been exposed and thereby eliminated the potential for the aging effect of cumulative fatigue damage. In addition, review of operating experience since the CRDRL nozzle cap replacement in 1986 indicates that no new cracking has occurred at this location. Because there is no potential for cumulative fatigue damage from flow cycling at the capped CRDRL safe end and no new cracking has been detected at this location since the nozzle was capped, the staff found the applicant's statement that cumulative fatigue damage does not apply to the CRDRL safe end cap in the RPV acceptable.

The applicant proposed to manage crack initiation and growth/SCC for the top head torus, flange, and dollar plate using the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program and Plant Chemistry Program. The material is identified as alloy steel (A533 Grade B Class and A508 Class 2) and clad (308/309).

The staff's review of LRA Section 3.1.2 identified an area for which it needed additional information to complete its evaluation of the applicant's results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.1.2-1, dated September 28, 2005, the staff requested that the applicant identify which materials provide the pressure boundary function and provide the basis, including any operating experience, for concluding that these materials are susceptible to crack initiation and growth due to SCC.

In its response, by letter dated October 28, 2005, the applicant responded that the base material provided the pressure boundary function and that operating experience identified in BWRVIP-74-A, "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal," indicates that the base material was susceptible to SCC. The staff reviewed this BWRVIP report and could find no operating experience indicating that the alloy steel base material will be susceptible to SCC. In its letter dated December 16, 2005, the applicant agreed with the staff that this aging mechanism does not affect the low-alloy base material and stated that it will revise the LRA accordingly as part of the annual update. By letter dated March 15, 2006, the applicant removed crack initiation and growth due to SCC as an AERM from the top head enclosure components in LRA Table 3.1.2-2. The staff agreed that crack initiation and growth is not an AERM for the alloy steel base material in a steam environment; therefore, the staff's concerns described in RAI 3.1.2-1 are resolved.

The applicant identified no aging effect for the external surface of the reactor vessel exposed to primary containment air. The staff agreed with this conclusion because the primary containment air has not caused degradation of the reactor vessel.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the applicant had demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.3 Reactor Coolant System—Reactor Pressure Vessel Internals—Summary of Aging Management Evaluation—Table 3.1.2-3

The staff reviewed LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the RPV internals component groups.

In LRA Table 3.1.2-3, the applicant proposed to manage crack initiation and growth due to cyclic loading of stainless steel materials for the steam dryer exposed to reactor coolant water or steam environment using AMP B2.1.12.

SER Section 3.0.3.2.11 documents the staff's evaluation of the BWR Vessel Internals Program. The applicant's BWR Vessel Internals Program monitors the condition of the BWR vessel internals for crack initiation and growth. The program includes in-vessel examination and plant water chemistry procedures. The in-vessel examination procedures implement the recommendations of the BWRVIP guidelines as well as the requirements of the ASME Code, Section XI. As a result of steam dryer failure at Quad Cities following an extended power uprate, steam dryers have been within the scope of license renewal pursuant to 10 CFR 54.4(a)(2), because it was shown that failure of the NSR component could prevent satisfactory accomplishment of intended functions of SR components. They may exhibit cracking due to flow-induced vibration or cyclic loading and therefore require an AMP.

LRA Table 3.1.2-3 identifies AMP B2.1.12 as the applicable program to manage the aging effect/mechanism of crack initiation and growth due to cyclic loading. The applicant, in note 136 of the LRA, stated that it will inspect the steam dryer using the guidelines in the approved BWRVIP topical report for steam dryer inspection and will reevaluate the inspection requirements if it installs a new steam dryer. Because the applicant's steam dryer inspections will be consistent with approved, industry-consensus inspection guidelines, the staff found that the applicant's proposed AMP is acceptable to manage the aging effect of crack initiation and growth due to cyclic loading of stainless steel material in the steam dryer exposed to a reactor coolant water or steam environment.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the applicant has demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.4 Reactor Coolant System—Reactor Recirculation System—Summary of Aging Management Evaluation—Table 3.1.2-4

The staff reviewed LRA Table 3.1.2-4, which summarizes the results of AMR evaluations for the REC system component groups.

In LRA Table 3.1.2-4, the applicant identified no aging effect for stainless steel fasteners, heat exchangers, manifolds, piping and fittings, pump casings, thermowells, and valve bodies exposed to a primary containment air environment.

In addition, it identified no aging effects for carbon steel and stainless steel components exposed to a lubricating oil environment. SER Section 3.1.2.3 documents the staff's evaluation.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the applicant has demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.5 Reactor Coolant System—Reactor Vessel Instrumentation—Summary of Aging Management Evaluation—Table 3.1.2-5

The staff reviewed LRA Table 3.1.2-5, which summarizes the results of AMR evaluations for the reactor vessel instrumentation component groups.

In LRA Table 3.1.2-5, the applicant identified no aging effect for stainless steel fasteners, manifolds, piping and fittings, restricting orifices, thermowells, and valve bodies exposed to a primary containment air environment. SER Section 3.1.2.3 documents the staff's evaluation.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the applicant has demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, AERM, and AMP combinations that the GALL Report does not evaluate. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the RCS components that are within the scope of license renewal and subject to an AMR will be adequately managed so that intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concluded that they adequately describe the AMPs credited for managing aging of the RCS, as required by 10 CFR 54.21(d).

3.2 Aging Management of Engineered Safety Features

This section of the SER documents the staff's review of the applicant's AMR results for the ESF components and component groups associated with the following systems:

- automatic pressure relief system
- combustible gas control system
- core spray system
- high pressure coolant injection system
- primary containment mechanical system
- reactor core isolation cooling system
- residual heat removal system
- secondary containment system

3.2.1 Summary of Technical Information in the Application

In LRA Section 3.2, the applicant provided AMR results for the ESF components and component groups. In LRA Table 3.2.1, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the ESF components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews involved evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a

review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the ESF components that are within the scope of license renewal and subject to an AMR will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In addition, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs are consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant had identified the appropriate GALL Report AMRs. SER Section 3.0.3 documents the staff's evaluations of the AMPs. The MNGP audit and review report details the staff's audit evaluation, as summarized in SER Section 3.2.2.1.

The staff also performed an onsite audit of those selected AMRs that are consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.2.2.2 of the SRP-LR. The MNGP audit and review report documents the staff's audit evaluations, which are summarized in SER Section 3.2.2.2.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that are not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether the applicant identified and evaluated all plausible aging effects and evaluating whether the aging effects listed are appropriate for the combination of materials and environments specified. The MNGP audit and review report documents the staff's audit evaluations. SER Section 3.2.2.3 documents these audit evaluations as well as the staff's evaluation of its technical review.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the ESF components.

Table 3.2-1 below summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.2, that are addressed in the GALL Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping, fittings, and valves in emergency core cooling system (Item Number 3.2.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components
Piping, fittings, pumps, and valves in emergency core cooling system (Item Number 3.2.1-02)	Loss of material due to general corrosion	Water chemistry, one-time inspection	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (see Section 3.2.2.2.2)
Components in containment spray (PWR only), standby gas treatment (BWR only), and containment isolation, and emergency core cooling systems (Item Number 3.2.1-03)	Loss of material due to general corrosion	Plant specific	One-Time Inspection Program (B2.1.23), System Condition Monitoring Program (B2.1.32)	Consistent with GALL, which recommends further evaluation (see Section 3.2.2.2.2)
Piping, fittings, pumps, and valves in emergency core cooling system (Item Number 3.2.1-04)	Loss of material due to pitting and crevice corrosion	Water chemistry, one-time inspection	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (see Section 3.2.2.2.3)
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems (Item Number 3.2.1-05)	Loss of material due to pitting and crevice corrosion	Plant specific	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (see Section 3.2.2.2.3)
Containment isolation valves and associated piping (Item Number 3.2.1-06)	Loss of material due to microbiologically influenced corrosion	Plant specific	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (see Section 3.2.2.2.4)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Seals in standby gas treatment system (Item Number 3.2.1-07)	Changes in properties due to elastomer degradation	Plant specific	One-Time Inspection Program (B2.1.23), System Condition Monitoring Program (B2.1.32)	Consistent with GALL, which recommends further evaluation (see Section 3.2.2.2.5)
High-pressure safety injection (charging) pump miniflow orifice (Item Number 3.2.1-08)	Loss of material due to erosion	Plant specific		Not applicable, PWR only (see Section 3.2.2.2.6)
Drywell and suppression chamber spray system nozzles and flow orifices (Item Number 3.2.1-09)	Plugging of nozzles and flow orifices due to general corrosion	Plant specific		Not applicable (see Section 3.2.2.2.7)
External surface of carbon steel components (Item Number 3.2.1-10)	Loss of material due to general corrosion	Plant specific	One-Time Inspection Program (B2.1.23), System Condition Monitoring Program (B2.1.32)	Consistent with GALL, which recommends further evaluation (see Section 3.2.2.2.2)
Piping and fittings of CASS in emergency core cooling system (Item Number 3.2.1-11)	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS		Not applicable. No CASS components susceptible to thermal aging embrittlement in engineered safety features
Components serviced by open-cycle cooling system (Item Number 3.2.1-12)	Local loss of material due to corrosion and/or buildup of deposit due to biofouling	Open-cycle cooling water system	One-Time Inspection Program (B2.1.23), Open-Cycle Cooling Water System Program (B2.1.24), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Components serviced by closed-cycle cooling system (Item Number 3.2.1-13)	Loss of material due to general, pitting, and crevice corrosion	Closed-cycle cooling water system	Closed-Cycle Cooling Water System Program (B2.1.13)	Consistent with GALL Report, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Emergency core cooling system valves and lines to and from HPCI and RCIC pump turbines (Item Number 3.2.1-14)	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion		This line item is not used at MNGP (see Section 3.2.2.1.1)
Pumps, valves, piping, and fittings in containment spray and emergency core cooling systems (Item Number 3.2.1-15)	Crack initiation and growth due to SCC	Water chemistry		Not applicable, PWR only
Pumps, valves, piping, and fittings in emergency core cooling systems (Item Number 3.2.1-16)	Crack initiation and growth due to SCC and IGSCC	Water chemistry, BWR stress corrosion cracking	BWR Stress Corrosion Cracking Program (B2.1.10), One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Carbon steel components (Item Number 3.2.1-17)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable, PWR only
Closure bolting in high-pressure or high-temperature systems (Item Number 3.2.1-18)	Loss of material due to general corrosion, loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading or SCC	Bolting integrity	Bolting Integrity Program (B2.1.4)	Consistent with GALL Report, which recommends no further evaluation

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in Section 3.2.2.1, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.2.2.2, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.2.2.3, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are not consistent with, or not addressed in, the GALL Report. SER Section 3.0.3 documents the staff's review of AMPs that are credited to manage or monitor aging effects of the ESF systems components.

3.2.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.2.2.1, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the ESF components:

- ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)
- Bolting Integrity Program (B2.1.4)
- Buried Piping & Tanks Inspection Program (B2.1.5)
- BWR Stress Corrosion Cracking Program (B2.1.10)
- Closed-Cycle Cooling Water System Program (B2.1.13)
- Flow-Accelerated Corrosion Program (B2.1.19)
- One-Time Inspection Program (B2.1.23)
- Open-Cycle Cooling Water System Program (B2.1.24)
- Plant Chemistry Program (B2.1.25)
- Selective Leaching of Materials Program (B2.1.30)
- System Condition Monitoring Program (B2.1.32)

Staff Evaluation. In LRA Tables 3.2.2-1 through 3.2.2-8, the applicant summarized the AMRs for the ESF components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the GALL Report evaluation bounds the plant-specific components contained in these GALL Report component groups.

The applicant provided a note for each AMR line item. The notes describe the relationship of the information in the tables to the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the staff had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component is applicable to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component applies to the component under review. The staff verified whether it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but the applicant credited a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP will manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs. The following sections discuss the staff's evaluation.

3.2.2.1.1 Wall Thinning Due to Flow-Accelerated Corrosion

In the discussion section of LRA Table 3.2.1, Item Number 3.2.1-14, the applicant stated the following:

> Aging effect is managed by the Flow-Accelerated Corrosion program.
>
> Consistent with NUREG-1801, some sections of the High Pressure Coolant Injection (HPC) and Reactor Core Isolation Cooling (RCI) systems are susceptible to flow-accelerated corrosion (FAC) and the Flow-Accelerated Corrosion Program is credited to manage the aging effect. The predominate sections of the HPC and RCI systems were evaluated as not susceptible to FAC based on material type or the components have no flow or operate less than 2% of the plant operating time. The components that fall in the latter category do not require aging management for FAC in accordance with EPRI, NSAC-202L, R2

and NUREG-1557, 'Summary of Technical Information and Agreements from the Nuclear Regulatory Management and Resources Council Industry Reports Addressing License Renewal.'

During the audit and review, the staff noted that the applicant did not use Table 3.2.1, Item 3.2.1-14, for Table 2 data. The staff reviewed the GALL Report (Sections V.D2.1-f, V.D2.3-a), which contains no line item covering ECCS piping in treated water susceptible to FAC. The applicant did not use Table 3.2.1, Item 3.2.1-14; instead, the applicant included ECCS piping and fittings exposed to treated water and susceptible to FAC in LRA Table 3.1.1, Item 3.1.1-25. This line item was a better match for the GALL Report (Section IV.C1.1-c) for materials, environment, aging effects, and components. The staff asked the applicant the reason for crediting another line item for this aging effect. The applicant responded that the GALL Report, Chapter V, contains no line item for ECCS piping in treated water susceptible to FAC; for this reason, the applicant did not use this line item. Instead the applicant used Table 1 Item 3.1.1-25 as a better match with the GALL Report (Section IV.C.1.1-c). By its letter dated August 11, 2005, the applicant revised the LRA Table 1, Item 3.2.1-14, from "Aging effect is managed by the FAC Program," to, "This line item is not used at MNGP."

On this basis, the staff found this program acceptable for managing aging of wall thinning due to FAC for some sections of the HPC and RCI systems. SER Section 3.0.3.1.2 documents the staff evaluation of the FAC Program.

On the basis of its review, the staff found that the applicant addressed the aging effect/mechanism as identified in the GALL Report.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. The staff's review concluded that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report; therefore, the staff concluded that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application. In LRA Section 3.2.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the ESF components. The applicant provided information concerning its management of the following aging effects:

- cumulative fatigue damage
- loss of material due to general corrosion
- local loss of material due to pitting and crevice corrosion
- local loss of material due to microbiologically influenced corrosion
- changes in properties due to elastomer degradation
- local loss of material due to erosion
- buildup of deposits due to corrosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.2.2.2 of the SRP-LR. The staff's audit and review report details the staff's audit. The following sections discuss the staff's evaluation of the aging effects.

3.2.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.2.2.2.1, the applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.2.2.2.2 Loss of Material Due to General Corrosion

The staff reviewed LRA Sections 3.2.2.2.2.1 and 3.2.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.

In LRA Section 3.2.2.2.2.1, the applicant addressed the loss of material due to general corrosion of piping, fittings, pumps, and valves in the ECCS. The applicant stated that the One-Time Inspection Program or a combination of the One-Time Inspection Program and Plant Chemistry Program manages the aging effect.

SRP-LR Section 3.2.2.2.2 states the following:

> The management of loss of material due to general corrosion of pumps, valves, piping, and fittings associated with some of the BWR emergency core cooling systems (high-pressure coolant injection, reactor core isolation cooling, high-pressure core spray, low-pressure core spray, low-pressure coolant injection (residual heat removal)) and with lines to the suppression chamber and to the drywell and suppression chamber spray system should be further evaluated. The existing aging management program relies on monitoring and control of primary water chemistry based on BWRVIP 29 (EPRI TR-103515) for BWRs to mitigate degradation. However, control of primary water chemistry does not preclude loss of material due to general corrosion at locations of stagnant flow conditions. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general corrosion to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

In LRA Section 3.2.2.2.2.1, the applicant stated that loss of material due to general corrosion of piping, fittings, pumps, and valves could occur in the ECCS and will be managed by the One-Time Inspection Program, or a combination of the One-Time Inspection Program and the Plant Chemistry Program. The applicant stated that, when applied in combination with the Plant

Chemistry Program, the scope of the One-Time Inspection Program incorporates activities to verify the effectiveness of the Plant Chemistry Program, including a sample of components where the flow of water is low or stagnant conditions exist.

SER Sections 3.0.3.1.4 and 3.0.3.2.19 document the staff's evaluations of the One-Time Inspection Program and the Plant Chemistry Program, respectively.

The applicant, in the LRA, included some component types subject to general corrosion (fans/blower housings and turbines) not consistent with the GALL Report; however, the materials, environments, and aging effects are similar. The staff found that these items will be properly managed during the period of extended operation. In addition, there are some aging mechanisms, galvanic corrosion and MIC, covered in LRA Section 3.2.2.2.2, managed by the One-Time Inspection Program and Plant Chemistry Program not consistent with the GALL Report. The staff requested that the applicant explain why it added these aging mechanisms. The applicant responded that these mechanisms could cause the aging effect, loss of material, and that this approach was conservative. The staff concluded that the applicant had taken a conservative approach to aging management and was consistent with the GALL Report.

Based on the technical information provided in LRA Section 3.2 and review of the One-Time Inspection and Plant Chemistry Programs, the staff found that the applicant appropriately addressed the aging effect/mechanism of loss of material due to general corrosion of pumps, valves, piping, and fittings associated with some of the ECCSs (HPC, RCI, low-pressure CSP, LPCI (RHR)) and lines to the suppression chamber and to the drywell and suppression chamber spray system for components in the ESF systems.

In LRA Section 3.2.2.2.2.2, the applicant addressed the loss of material due to general corrosion of components in the standby gas treatment and containment isolation systems, and ECCS. The applicant stated that the One-Time Inspection Program or the System Condition Monitoring Program manages the aging effect.

SRP-LR Section 3.2.2.2.2.2 states the following:

> Loss of material due to general corrosion could occur in the drywell and suppression chamber spray (BWR) systems header and spray nozzle components, standby gas treatment system components (BWR), containment isolation valves and associated piping, the automatic depressurization system piping and fittings (BWR), emergency core cooling system header piping and fittings and spray nozzles (BWR), and the external surfaces of BWR carbon steel components. The GALL Report recommends further evaluation on a plant-specific basis to ensure that the aging effect is adequately managed.

The applicant stated in LRA Section 3.2.2.2.2.2, that the One-Time Inspection Program and/or the System Condition Monitoring Program manages the aging effect for an air/gas environment.

The LRA describes the One-Time Inspection Program as a new AMP. The scope of this new AMP includes activities to verify potential long incubation periods for certain aging effects on SCs. The environments applicable to this item are characteristic of long incubation periods (air/gas environments with the potential for moisture). The staff evaluated the One-Time Inspection Program and found it acceptable for managing the aging effects of loss of material due to general corrosion. SER Section 3.0.3.1.4 documents the evaluation of the One-Time Inspection Program.

The LRA describes the System Condition Monitoring Program as an existing plant-specific program that manages aging effects for normally accessible, external surfaces of piping, tanks, and other components and equipment within the scope of license renewal. The applicant manages these aging effects through visual inspection and monitoring of external surfaces for leakage and evidence of material degradation.

The staff considers visual inspection an examination technique capable of detecting loss of material due to various aging mechanisms (e.g., general or galvanic corrosion) on the exterior surface of components, and the staff considers an examination frequency of once per year or per refueling outage adequate for the detection of this effect before the loss of component function occurs. The staff's review found the System Condition Monitoring Program acceptable for managing aging of general corrosion during the period of extended operation. SER Section 3.0.3.3.2 documents the evaluation of the System Conditioning Monitoring Program.

The System Conditioning Monitoring Program and One-Time Inspection Program cover aging management in the drywell and suppression chamber spray, systems header and spray nozzle components, standby gas treatment system (SGTS) components, containment isolation valves and associated piping, the automatic depressurization system piping and fittings, ECCS header piping and fittings and spray nozzles, and the external surfaces of carbon steel components.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.2. For those line items that apply to LRA Sections 3.2.2.2.2.1 and 3.2.2.2.2.2, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.3 Local Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Sections 3.2.2.2.3.1 and 3.2.2.2.3.2 against the criteria in SRP-LR Section 3.2.2.2.3.

In LRA Section 3.2.2.2.3.1, the applicant addressed the loss of material due to pitting and crevice corrosion of piping, fittings, pumps, and valves in the ECCS. The applicant stated that the One-Time Inspection Program, or the combination of the One-Time Inspection Program and Plant Chemistry Program, manages the aging effect.

SRP-LR Section 3.2.2.2.3 states the following:

> The management of local loss of material due to pitting and crevice corrosion of pumps, valves, piping, and fittings associated with some of the BWR emergency core cooling system piping and fittings (high-pressure coolant injection, reactor core isolation cooling, high-pressure core spray, low-pressure core spray, low-pressure coolant injection (residual heat removal)) and with lines to the suppression chamber and to the drywell and suppression chamber spray system should be evaluated further. The existing aging management program relies on

monitoring and control of primary water chemistry based on EPRI guidelines of TR-105714 for PWRs and BWRVIP 29 (EPRI TR-103515) for BWRs to mitigate degradation. However, control of coolant water chemistry does not preclude loss of material due to crevice and pitting corrosion at locations of stagnant flow conditions. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage the loss of material due to pitting and crevice corrosion to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly so that the component's intended function will be maintained during the period of extended operation.

In LRA Section 3.2.2.2.3.1, the applicant addressed loss of material due to pitting and crevice corrosion of piping, fittings, pumps, and valves in the ECCS. The applicant stated that the One-Time Inspection Program, or the combination of the One-Time Inspection Program and Plant Chemistry Program, manages the aging effect. When applied in combination with the Plant Chemistry Program, the scope of the One-Time Inspection Program incorporates activities to verify the effectiveness of the Plant Chemistry Program, including a sample of components where the flow of water is low or stagnant conditions exist. Implementation of the One-Time Inspection Program and the Plant Chemistry Program to manage the aging effect provides added assurance that the aging effect is not occurring or that the aging effect is progressing very slowly, such that the component's intended function will be maintained during the period of extended operation.

As documented in the audit and review report, the applicant stated that in some instances, the component within the scope of license renewal has an environment that does not lend itself to benefits from the Plant Chemistry Program (low-flow stagnant conditions, or an air/gas environment). The staff determined that the use of the One-Time Inspection Program alone in certain cases, such as no-flow conditions, in which the use of the Plant Chemistry Program is not a viable option, is acceptable. The staff concluded, based on MNGP technical procedures, that this is an appropriate aging management method based on the details of the program's sampling locations, frequencies, and corrective actions.

The applicant uses the One-Time Inspection Program, or the combination of the One-Time Inspection Program and the Plant Chemistry Program, to manage the aging effect/mechanism of loss of material due to pitting and crevice corrosion for areas of stagnant flow. The staff evaluated the One-Time Inspection Program and Plant Chemistry Program, as documented in SER Sections 3.0.3.1.4 and 3.0.3.2.19, respectively.

The staff reviewed the applicant's programs credited for aging management for the materials, environment, and aging effects/mechanisms. The pumps, valves, piping, and fittings associated with some of the BWR ECCS piping and fittings (HPC, RCI, low-pressure CSP, LPCI (RHR)) and with lines to the suppression chamber and to the drywell and suppression chamber spray system are subject to local loss of material due to pitting and crevice corrosion. The One-Time Inspection Program or the combination of the Plant Chemistry Program and the One-Time Inspection Program manages the aging effects.

In LRA Section 3.2.2.2.3.2, the applicant addressed loss of material due to pitting and crevice corrosion of components in the standby gas treatment and containment isolation systems, and ECCS. The applicant stated that the One-Time Inspection Program, or the combination of the One-Time Inspection Program and Plant Chemistry Program, manages the aging effect.

SRP-LR Section 3.2.2.2.3.2 states the following:

> Local loss of material from pitting and crevice corrosion could occur in the containment isolation valves and associated piping, and automatic depressurization system piping and fittings (BWR). The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In LRA Section 3.2.2.2.3.2, the applicant stated that the One-Time Inspection Program is a new AMP. The scope of this new AMP will include activities to verify potential long incubation periods for certain aging effects on SCs. The environments applicable to this item are characteristic of long incubation periods (air/gas environments with the potential for moisture). This program is sometimes used by itself in locations where the Plant Chemistry Program will not be effective (such as air/gas or low-flow/stagnant environments). The staff determined that the use of the One-Time Inspection Program alone in certain cases, such as no-flow conditions, in which the use of the Plant Chemistry Program is not a viable option, is acceptable.

The staff evaluated the Plant Chemistry and One-Time Inspection Programs and found them acceptable for managing the aging effect of local loss of material from pitting and crevice corrosion that could occur in the containment isolation valves and associated piping, and ADS piping and fittings. SER Sections 3.0.3.2.19 and 3.0.3.1.4 document the staff's evaluation of the Plant Chemistry Program and One-Time Inspection Program, respectively.

The staff evaluated both of these AMPs with respect to applications to the materials, environment, and aging effects. The applicant included an additional aging mechanism (galvanic corrosion) not consistent with the GALL Report (Sections V.C.1-a/b, V.D2.1-e). The staff determined that the applicant used a conservative approach for aging management by including this additional aging mechanism, and that this is consistent with the GALL Report for the aging effect.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.3. For those line items that apply to LRA Sections 3.2.2.2.3.1 and 3.2.2.2.3.2, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.4 Local Loss of Material Due to Microbiologically Influenced Corrosion

The staff reviewed LRA Section 3.2.2.2.4 against the criteria in SRP-LR Section 3.2.2.2.4.

In LRA Section 3.2.2.2.4, the applicant addressed loss of material due to MIC of valves and associated piping in containment isolation.

SRP-LR Section 3.2.2.2.4 states the following:

> Local loss of material due to microbiologically influenced corrosion (MIC) could occur in BWR and PWR containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL Report. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

Although the applicant does not use this line item at MNGP, the loss of material due to MIC is predicted for ESF system valve bodies and associated piping. The applicant credited a combination of the Plant Chemistry Program and the One-Time Inspection Program for the aging effect. The staff evaluated the Plant Chemistry Program and One-Time Inspection Program and found them acceptable for managing aging of local loss of material from MIC that could occur in the containment isolation valves and associated piping, and ADS piping and fittings. SER Sections 3.0.3.2.19 and 3.0.3.1.4 document the evaluation of the Plant Chemistry Program and One-Time Inspection Program, respectively.

The applicant's LRA is consistent with the GALL Report (Section V.C.1-a/b) for components, materials, environment, and programs for managing aging for the containment isolation valves. Based on the information provided by the applicant, as noted in the LRA, the staff's review and audit found that the applicant's AMPs are acceptable for management of loss of material due to MIC for the containment isolation valves and associated piping.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.4. For those line items that apply to LRA Section 3.2.2.2.4, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.5 Changes in Properties Due to Elastomer Degradation

The staff reviewed LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5.

In LRA Section 3.2.2.2.5, the applicant addressed the change in material properties of seals in the SGTS. The applicant stated that the One-Time Inspection Program manages the aging effect for the internal environment and the System Condition Monitoring Program manages it for the external environment. The System Condition Monitoring Program is an existing plant-specific program.

SRP-LR Section 3.2.2.2.5 states the following:

> Changes in properties due to elastomer degradation could occur in seals associated with the standby gas treatment system ductwork and filters. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

The One-Time Inspection Program is a new AMP, the scope of which includes activities to verify potential long incubation periods for certain aging effects on SCs. The environments applicable to this item are characteristic of long incubation periods (high-temperature air or ozone). The staff evaluated the One-Time Inspection Program and found it acceptable and consistent with the GALL Report for managing this aging effect. SER Section 3.0.3.1.4 documents the evaluation of the One-Time Inspection Program.

The System Condition Monitoring Program is an existing plant-specific program that is based on system engineer monitoring, and it is used to manage the aging effect/mechanisms on system components in the ESF, including elastomer degradation of seals in the SGTS ductwork and filters. The staff reviewed the System Condition Monitoring Program and found it acceptable and consistent with the GALL Report for managing this aging effect/mechanism. SER Section 3.0.3.3.2 documents the evaluation of the System Condition Monitoring Program.

The staff reviewed the applicant's use of the One-time Inspection Program and System Condition Monitoring Program (which is periodic) and determined that it is acceptable and consistent with the GALL Report (Sections V.B.1-b, V.B.2-b) as the programs will verify the condition of the elastomer seals and provide reasonable assurance that hardening and cracking do not occur. The staff found that the materials, environment, aging effects, and the aging programs are consistent with the GALL Report. The applicant manages these aging effects through visual inspection of internal surfaces and monitoring of external surfaces for leakage and evidence of material degradation.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.5. For those line items that apply to LRA Section 3.2.2.2.5, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.6 Local Loss of Material Due to Erosion

The staff reviewed LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6.

In LRA Section 3.2.2.2.6, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.2.2.2.6 states that local loss of material due to erosion could occur in the high-pressure safety injection pump miniflow orifice. SRP-LR Table 3.2-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.2.2.2.7 Buildup of Deposits Due to Corrosion

The staff reviewed LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7.

In LRA Section 3.2.2.2.7, the applicant addressed plugging of nozzles and flow orifices in the drywell and suppression chamber spray system due to general corrosion. The drywell and suppression chamber spray system nozzles are fabricated from copper alloy materials, which are not susceptible to loss of material (plugging of nozzles and flow orifices) due to general corrosion; therefore, no aging management is required. The associated GALL Report line item (Section V.D2.5-b) does not evaluate copper alloy material.

SRP-LR Section 3.2.2.2.7 states the following:

> The plugging of components due to general corrosion could occur in the spray nozzles and flow orifices of the drywell and suppression chamber spray system. This aging mechanism and effect will apply since the spray nozzles and flow orifices are occasionally wetted, even though the majority of the time this system is on standby. The wetting and drying of these components can aid in the acceleration of this particular corrosion. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

The staff reviewed the GALL Report (Section V.D2.5-b), which addresses only carbon steel in an air environment for drywell suppression chamber spray systems. The materials at MNGP are made of copper in an air/potential water environment, which the GALL Report does not address. After reviewing documentation from the GALL Report for aging effects, materials, and environments, the staff concurred that these nozzles are not subject to aging effects in the environments listed according to material science evaluations (as noted below) and, therefore, are not susceptible to corrosion product buildup that could cause plugging.

As shown in the *Metals Handbook*, Ninth Edition, Volume 13, "Corrosion," comprehensive tests over a 20-year period under the supervision of ASTM confirmed the suitability of copper alloys for atmospheric exposure. Additionally, the gaseous internal environments to which components within the scope of license renewal may be subject include air, nitrogen, carbon dioxide, freon, and halon. Industry experience suggests that copper piping exposed to an internal gaseous operating condition will be resistant to any age-related degradation; therefore, the SC will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

On the basis of its review of current industry research and operating experience, the staff found that effects of the listed environments on the listed materials will not cause aging of concern during the period of extended operation; therefore, the staff concluded that there are no applicable AERMs for the component material and environment described in the preceding discussion.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.7. For those line items that apply to LRA Section 3.2.2.2.7, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Conclusion</u>. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that intended functions

will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.2.2-1 through 3.2.2-8, the staff reviewed additional details of the results of the AMRs for material, environment, AERM, and AMP combinations that are not consistent with the GALL Report, or that are not addressed in the GALL Report.

In LRA Tables 3.2.2-1 through 3.2.2-8, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report, and provided information concerning the management of the aging effect. Specifically, Note F indicates that the GALL Report does not evaluate the material for the AMR line item component. Note G indicates that the GALL Report does not evaluate the environment for the AMR line item component and material. Note H indicates that the GALL Report does not evaluate the aging effect for the AMR line item component, material, and environment combination. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that the GALL Report evaluates neither the component nor the material and environment combination for the line item.

Staff Evaluation. For component type, material, and environment combinations that the GALL Report does not evaluate, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The following sections discuss the staff's evaluation.

In LRA Tables 3.2.2-1 through 3.2.2-8, the staff identified AMR line items for which the applicant stated that there were no aging effects as a result of the AMR process. In most instances, the applicant identified materials that have no aging effects in the environments they are exposed to during plant operations. The applicant stated that no aging effects occur for ESF system components fabricated from the following materials:

- copper
- carbon steel
- nickel alloy
- stainless steel
- CASS
- insulation

These materials are exposed to the following environments:

- plant indoor air (external/internal)
- primary containment air (external/internal)
- air/gas (internal)
- gas—instrument air (internal)
- gas—nitrogen (internal)

- lubricating oil (external/internal)
- outdoor air protected

The applicant stated that components fabricated from these materials in these environments have no aging effects based on material science evaluations of these materials exposed to atmospheric conditions. Specifically, the applicant stated that no aging effects occur when components fabricated from stainless steel material are exposed to a primary containment air, plant indoor air (and outdoor air protected), lubricating oil, or gas (instrument air) environment, or when components fabricated from copper alloys are exposed to a primary containment air, plant indoor air, lubricating oil, or gas (instrument air) environment. The applicant also stated that no aging effects occur in components fabricated from carbon steel in a gas (nitrogen or instrument air) or lubricating oil environment. In addition, the applicant stated that no aging effects occur in components fabricated from CASS or nickel alloys in a primary containment air or plant indoor air environment. The applicant stated that a material science evaluation for these materials in these environments found no aging effects.

The GALL Report states that steel, copper, nickel alloy, and stainless steel in an environment of plant indoor air (external), gas, and lubricating oil are not subject to any aging mechanisms. The staff reviewed this technical information against LRA Tables 3.2.2-1 through 3.2.2-8 and concluded that the applicant's analysis of the material and environment combinations will allow components within the scope of license renewal fabricated from these materials in these environments to perform their intended functions through the period of extended operation. This conclusion is based on industry and plant operating experience of these components in these environments.

As cited in *Metals Handbook*, Ninth Edition, Volume 13, stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species; therefore, stainless steel in an indoor, uncontrolled air environment (e.g., plant indoor air) or in a gas environment (e.g., primary containment air inerted with nitrogen) exhibits no aging effect, and such an SC will remain capable of performing intended functions consistent with the CLB for the period of extended operation. Because both oxygen and moisture must be present to corrode steel, as cited in *Metals Handbook*, Ninth Edition, steel (carbon or stainless) and copper alloys in a lubricating oil internal environment with no water pooling exhibit no aging effect, and such an SC will therefore remain capable of performing intended functions consistent with the CLB for the period of extended operation. Because components fabricated from CASS, copper, and nickel alloys are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as cited in the *Metals Handbook*, Ninth Edition, the staff accepted the position that CASS, copper, and nickel alloys in an indoor (primary containment), uncontrolled air environment (e.g., plant indoor air), or gas environment (e.g., plant instrument air) exhibit no aging effect, and such SCs will therefore remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Tables 3.2.2.4 and 3.2.2.7 list insulation for piping and heat exchangers in the HPC and RHR systems exposed to plant indoor air. LRA Section 3.2.1 states that the GALL Report does not show this material for this component as subject to aging management.

The staff reviewed technical information based on industry experience and concluded that the applicant's analysis of the material and environment is acceptable, and insulation exposed to plant indoor air will remain capable of performing its intended function during the period of extended operation.

The staff reviewed the materials and environments for this section and compared this information with the technical references noted above. Except for carbon steel in outdoor air, the ESF components fabricated from carbon steel, nickel alloy, stainless steel, CASS, and insulation subject to plant indoor air (external/internal), primary containment air (external/internal), air/gas (internal), gas (instrument air/nitrogen), lubricating oil (external/internal), or outdoor air are not subject to aging effects/mechanisms.

On the basis of its review of current industry research and operating experience, the staff found that the listed materials in the listed environments will not experience aging effects of concern during the period of extended operation; therefore, the staff concluded that there are no applicable AERMs for the component material and environment described in the preceding discussion.

3.2.2.3.1 Engineered Safety Features—Automatic Pressure Relief System—Summary of Aging Management Evaluation—Table 3.2.2-1

The staff reviewed LRA Table 3.2.2-1, which summarizes the results of AMR evaluations for the automatic pressure relief system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.2.2.3 above.

3.2.2.3.2 Engineered Safety Features—Combustible Gas Control System—Summary of Aging Management Evaluation—Table 3.2.2-2

In its letter dated March 15, 2006, the applicant stated that it deactivated the CGC system by cutting and capping process lines connecting to interfacing systems during the 2005 refueling outage because of NRC approval of License Amendment 138, which eliminated the requirements for hydrogen recombiners and relaxed the requirements for hydrogen and oxygen monitoring. Therefore, the system has been removed from the scope of license renewal.

3.2.2.3.3 Engineered Safety Features—Core Spray System—Summary of Aging Management Evaluation—Table 3.2.2-3

The staff reviewed LRA Table 3.2.2-3, which summarizes the results of AMR evaluations for the CSP system component groups.

In LRA Table 3.2.2-3, the applicant proposed to manage loss of material due to crevice corrosion, MIC, and pitting corrosion of copper alloys for ESF heat exchangers exposed to a raw water environment using the Open-Cycle Cooling Water Program.

The OCCW System Program relies on the implementation of the recommendations of GL 89-13 to ensure that the effects of aging on the raw water service water systems will be managed for the period of extended operation. This program manages the aging effects of metallic components in water systems (e.g., piping and heat exchangers) exposed to raw, untreated (e.g., service) water. The staff reviewed the OCCW System Program and found it to be acceptable and consistent with the GALL Report. SER Section 3.0.3.1.5 documents the evaluation of the OCCW System Program. The staff determined that this AMP is adequate for managing this material, environment, and aging effect.

In LRA Table 3.2.2-3, the applicant proposed to manage loss of material due to selective leaching of copper alloys for ESF heat exchangers in a raw water environment using the Selective Leaching of Materials Program.

The staff reviewed the applicant's Selective Leaching of Materials Program, and SER Section 3.0.3.2.22 documents its evaluation. This new program includes a one-time visual inspection and hardness measurement of certain components susceptible to selective leaching. The program will determine if selective leaching occurs for certain components. The staff determined that this AMP is adequate for managing this material, environment, and aging effect.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the aging effect of loss of material due to crevice corrosion, MIC, and pitting corrosion and loss of material due to selective leaching of copper alloys for ESF heat exchangers exposed to raw water environment in LRA Table 3.2.2-3 are effectively managed using the OCCW System Program and the Selective Leaching of Materials Program, respectively.

3.2.2.3.4 Engineered Safety Features—High-Pressure Coolant Injection System—Summary of Aging Management Evaluation—Table 3.2.2-4

The staff reviewed LRA Table 3.2.2-4, which summarizes the results of AMR evaluations for the HPC system component groups.

In LRA Table 3.2.2-4, the applicant proposed to manage heat transfer degradation and fouling of heat exchangers fabricated from copper alloy in lubricating oil (external)/treated water (internal) environments with the One-Time Inspection Program, and in steam (external)/treated water (internal) environments using the Plant Chemistry Program combined with the One-Time Inspection Program. The applicant also proposed to manage the loss of material due to crevice corrosion and pitting corrosion of heat exchangers fabricated from copper alloy in steam (external)/treated water (internal) environments, and MIC in a treated water (internal) environment using the Plant Chemistry Program, combined with the One-Time Inspection Program.

The staff reviewed the applicant's Plant Chemistry Program and the One-Time Inspection Program, and SER Sections 3.0.3.2.19 and 3.0.3.1.4, respectively, document its evaluation of each. The Plant Chemistry Program mitigates the aging effects on component surfaces exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth or that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits. The new One-Time Inspection Program is consistent with the recommendations of GALL AMP XI.M32. This program will include measures to verify the effectiveness of the Plant Chemistry Program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within the scope of license renewal. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs. If system contaminants are maintained within the limits specified by the Plant Chemistry Program, the corrosion exhibited by the copper alloy in a closed system is adequately managed. The applicant has chosen a different combination of AMPs to manage the AERM. The staff found this combination adequate and acceptable for managing this material, environment, and aging effect, because contaminants are maintained within limits to inhibit corrosion of the copper alloy.

The staff's review of LRA Section 3.2 identified areas for which it needed additional information to complete its evaluation of the applicant's results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.2-1, dated July 20, 2005, the staff noted that in LRA Table 3.2.2-4, the applicant stated that it would manage heat transfer degradation due to fouling of heat exchangers fabricated from copper alloy in a lubricating oil environment using the One Time Inspection Program. On the basis of the staff's review of the information provided in the LRA, it was not clear what preventive measures the applicant was taking to ensure that the lubricating oil remains free of contaminants that might degrade the tubing. Therefore, the staff requested that the applicant provide the following:

a) Specific material composition of the copper alloys.

b) A description of the oil analysis program and/or other methods to ensure that the lubricating oil remains free of contaminants which might degrade the tubing.

c) PM procedures to ensure that heat transfer degradation does not reach unacceptable levels.

In its response, by letter dated August 16, 2005, the applicant stated the following:

a) The High Pressure Coolant Injection System (HPC) lubricating oil cooler (E-206) is an American Standard (Whitlock) cooler of carbon steel construction with 5/8" O.D. Admiralty tubes in accordance with the vendor's technical manual. Admiralty brass is composed of 71Cu-28Zn-1Sn.

b) Lube oil samples from the HPC lube oil cooler are obtained every six months in accordance with MNGP site procedures, and the sample results are evaluated and trended. These parameters include iron, copper, etc. for indications of wear, dielectric, viscosity, etc. for chemical analysis and water, silicon, etc. for indication of contamination. Sampling is performed IAW EPRI 1007459 (November 2002) for the HPC lube oil cooler. Electric Power Research Institute (EPRI) Report 1007459 recommends that 'oil moisture content be verified on a monthly basis and that acidity, viscosity, and particle count be verified each quarter until a data trending program can justify extending the inspection frequency.' This frequency, based upon data trending results, was extended to a six-month frequency. Any indication of an anomalous condition or adverse trend will result in an investigation under the site corrective action program. All results have been acceptable to date to ensure that the lubricating oil remains free of contaminants that could potentially degrade the heat exchanger (cooler) tubes, with the last sample taken and evaluated in March 2005.

c) Preventive maintenance procedures are in effect to both clean and inspect the HPC lube oil cooler and perform eddy current testing every three cycles. Eddy current testing was last performed in January 2000 on the originally installed cooler. All tubes were inspected. No tubes required plugging and no unacceptable defects were detected.

Based on its review, the staff found the applicant's response to RAI 3.2-1 acceptable because the lube oil coolers are monitored and tested in accordance with industry standards and NRC guidelines. In addition, the applicant's operational experience supports the adequacy of its maintenance practices; therefore, the staff's concern described in RAI 3.2-1 is resolved.

In RAI 3.2-2, dated July 20, 2005, the staff noted that in LRA Table 3.2.2-4, the applicant stated that it will manage heat transfer degradation due to fouling of the copper alloy heat exchanger tubes in a steam environment with the Plant Chemistry and One-Time Inspection Programs. The applicant further stated that the GALL Report does not evaluate either the components or the material and environment combination; therefore, the staff requested that the applicant verify that the steam in the heat exchangers identified above originated from treated water. In addition, the staff requested the applicant to justify not considering erosion and FAC as aging mechanisms for this material and environment combination.

In its response, by letter dated August 16, 2005, the applicant stated the following:

> Per LRA 2.3.2.4, High Pressure Coolant Injection (HPC) System, 'The HPC turbine is driven with steam from the RPV. Two sources of water are available for the HPC System. Normally, water is supplied to the suction of the HPC pump from the two condensate storage tanks (CST). When the level in either CST falls to the predetermined setpoint, the pump suction is automatically transferred to the suppression pool.' The HPC heat exchanger in question is the HPC Gland Seal Condenser, E-204, which condenses the gland seal steam from the HPC turbine by using cooling water from the discharge of the HPC pump. Therefore, the steam in this heat exchanger is produced by the treated water in the RPV.
>
> EPRI NSAC 202L, R2, 'Recommendations for an Effective Flow-Accelerated Corrosion (FAC) Program,' page 4-3, allows an exclusion from FAC for systems which operate less than 2% of the time, which would be applicable to this HPC condenser. In addition, this component is not subject to high velocity, constricted flow, or fluid direction changes. Therefore, in accordance with EPRI 1003056, 'Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools,' Revision 3, loss of material due to erosion or FAC are not potential aging mechanisms.

Based on its review, the staff found the applicant's response to RAI 3.2-2 acceptable because the applicant provided satisfactory explanations of the purity of the steam environment and the absence of erosion and FAC as aging mechanisms for the heat exchanger in question; therefore, the staff's concern described in RAI 3.2-2 is resolved.

In LRA Table 3.2.2-4, the applicant proposed to manage the loss of material due to selective leaching of heat exchangers fabricated from copper alloy in a steam (external)/treated water (internal) environment with the Selective Leaching of Materials Program.

The staff reviewed the applicant's Selective Leaching of Materials Program, and SER Section 3.0.3.2.22 documents its evaluation. This new program includes a one-time visual inspection and hardness measurement of selected components susceptible to selective leaching. The program will determine if selective leaching occurs for selected components. The staff found this program adequate for managing this material, environment, and aging effect.

3.2.2.3.5 Engineered Safety Features—Primary Containment Mechanical System—Summary of Aging Management Evaluation—Table 3.2.2-5

The staff reviewed LRA Table 3.2.2-5, which summarizes the results of AMR evaluations for the primary containment mechanical system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.2.2.3 above.

3.2.2.3.6 Engineered Safety Features—Reactor Core Isolation Cooling System—Summary of Aging Management Evaluation—Table 3.2.2-6

The staff reviewed LRA Table 3.2.2-6, which summarizes the results of AMR evaluations for the RCI system component groups.

In LRA Table 3.2.2-6, the applicant proposed to manage heat transfer degradation and fouling of heat exchangers fabricated from copper alloy in a lubricating oil (external) environment with the One-Time Inspection Program, and in a treated water (internal) environment with the Plant Chemistry Program, combined with the One-Time Inspection Program. The applicant also proposed to manage the loss of material due to crevice corrosion, pitting corrosion, and MIC of heat exchangers fabricated from copper alloy in a treated water (internal) environment with the Plant Chemistry Program, combined with the One-Time Inspection Program.

The staff reviewed and evaluated the applicant's Plant Chemistry Program and the One-Time Inspection Program, as documented in SER Sections 3.0.3.2.19 and 3.0.3.1.4, respectively. The Plant Chemistry Program mitigates the aging effects on component surfaces exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth or that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits. The new One-Time Inspection Program is consistent with the recommendations of GALL AMP XI.M32. This program will include measures to verify the effectiveness of the Plant Chemistry Program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within scope of license renewal. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs. If system contaminants are maintained within the limits specified by the Plant Chemistry Program, the corrosion exhibited by the copper alloy in a closed system is adequately managed. The applicant has chosen a different combination of AMPs to manage the AERM. The staff found this combination adequate and acceptable for managing this material, environment, and aging effect, because contaminants are maintained within limits to inhibit corrosion of the copper alloy.

The response to RAI 3.2-1, discussed in SER Section 3.2.2.3.4, is generally applicable to the copper alloy components of the heat exchangers in the RCI system.

The staff found the applicant's response reasonable and acceptable because the lube oil coolers are monitored and tested in accordance with industry standards and NRC guidelines. In addition, the applicant's operational experience supports the adequacy of its maintenance practices.

In LRA Table 3.2.2-6, the applicant proposed to manage the loss of material due to selective leaching of heat exchangers fabricated from copper alloy in a treated water (internal) environment using the Selective Leaching of Materials Program.

The staff reviewed and evaluated the applicant's Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement of certain components susceptible to selective leaching. The program will determine if selective leaching occurs for certain components. The staff found this program adequate and acceptable for managing this material, environment, and aging effect.

3.2.2.3.7 Engineered Safety Features—Residual Heat Removal System—Summary of Aging Management Evaluation—Table 3.2.2-7

The staff reviewed LRA Table 3.2.2-7, which summarizes the results of AMR evaluations for the RHR system component groups.

In LRA Table 3.2.2-7, the applicant proposed to manage heat transfer degradation and fouling of heat exchangers fabricated from copper alloy in a lubricating oil (external) environment with the One-Time Inspection Program, and in a raw water (internal) environment using the Open-Cycle Cooling Water System Program. The applicant also proposed to manage the loss of material due to crevice corrosion, MIC, and pitting corrosion of heat exchangers fabricated from copper alloy in a raw water (internal) environment using the Open-Cycle Cooling Water System Program.

The staff reviewed and evaluated the applicant's One-Time Inspection Program, as documented in SER Section 3.0.3.1.4. The new One-Time Inspection Program, consistent with the recommendations of GALL AMP XI.M32, will confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within the scope of license renewal. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs.

The OCCW System Program relies on the implementation of the recommendations of GL 89-13 to ensure that the effects of aging on the raw water service water systems will be managed for the period of extended operation. This program manages the aging effects of metallic components in water systems (e.g., piping and heat exchangers) exposed to raw, untreated (e.g., service) water. The staff reviewed the OCCW System Program and found it acceptable and consistent with the GALL Report. SER Section 3.0.3.1.5 documents the evaluation of the

OCCW System Program. The staff has found this AMP adequate and acceptable for managing this material, environment, and aging effect.

In LRA Table 3.2.2-7, the applicant proposed to manage the loss of material due to MIC, crevice corrosion, and pitting corrosion of RHR nozzles fabricated from copper alloy in a treated water (internal) environment with the Plant Chemistry Program, combined with the One-Time Inspection Program.

The staff reviewed and evaluated the applicant's Plant Chemistry Program and the One-Time Inspection Program, as documented in SER Sections 3.0.3.2.19 and 3.0.3.1.4, respectively. The Plant Chemistry Program mitigates the aging effects on component surfaces exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth, or that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits.

The new One-Time Inspection Program, consistent with the recommendations of GALL AMP XI.M32, will include measures to verify the effectiveness of the Plant Chemistry Program and will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within the scope of license renewal. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs. If system contaminants are maintained within the limits specified by the Plant Chemistry Program, the corrosion exhibited by the copper alloy in a closed system is adequately managed. The applicant has chosen a different combination of AMPs to manage the AERM. The staff found this combination adequate and acceptable for managing this material, environment, and aging effect, because contaminants are maintained within limits to inhibit corrosion of the copper alloy.

In LRA Table 3.2.2-7, the applicant proposed to manage the loss of material due to selective leaching of heat exchangers fabricated from copper alloy in a raw water (internal) environment, and RHR nozzles fabricated from copper alloy in a treated water (internal) environment with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the applicant's Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement of certain components susceptible to selective leaching. Because the program will determine if selective leaching occurs for certain components, the staff found this AMP adequate and acceptable for managing this material, environment, and aging effect.

In LRA Table 3.2.2-7, the applicant contends that no aging effects are associated with thermal insulation installed on heat exchangers and exposed to an indoor plant air environment. The staff concurred with the applicant's assessment and found the applicant's routine maintenance practices adequate to maintain the thermal insulation of the RHR heat exchangers effectively.

3.2.2.3.8 Engineered Safety Features—Secondary Containment System—Summary of Aging Management Evaluation—Table 3.2.2-8

The staff reviewed LRA Table 3.2.2-8, which summarizes the results of AMR evaluations for the secondary containment system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.2.2.3 above.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the ESF components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concluded that they adequately describe the AMPs credited for managing aging of the ESF, as required by 10 CFR 54.21(d).

3.3 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary systems components and component groups associated with the following systems:

- alternate nitrogen system
- chemistry sampling system
- circulating water system
- control rod drive system
- demineralized water system
- emergency diesel generators system
- emergency filtration train system
- emergency service water system
- fire system
- fuel pool cooling and cleanup system
- heating and ventilation system
- instrument and service air system
- radwaste solid and liquid system
- reactor building closed cooling water system
- reactor water cleanup system

- service and seal water system
- standby liquid control system
- wells and domestic water system

3.3.1 Summary of Technical Information in the Application

In LRA Section 3.3, the applicant provided AMR results for the auxiliary systems components and component groups. In LRA Table 3.3.1,the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the auxiliary systems components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components that are within the scope of license renewal and subject to an AMR will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In addition, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs are consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs. SER Section 3.0.3 documents the staff's evaluations of the AMPs. The MNGP audit and review report details the staff's audit evaluation, which is summarized in SER Section 3.3.2.1.

The staff also performed an onsite audit of those selected AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.3.2.2 of the SRP-LR. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in SER Section 3.3.2.2.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that are not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether the applicant identified all plausible aging effects and whether the aging effects listed are appropriate for the combination of materials and environments specified. The MNGP audit and review report documents the staff's audit evaluations. SER Section 3.3.2.3 summarizes the staff's audit evaluations and documents its technical review.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the auxiliary systems components.

Table 3.3-1 below summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report.

Table 3.3-1 Staff Evaluation for Auxiliary Systems Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in spent fuel pool cooling and cleanup (Item Number 3.3.1-01)	Loss of material due to general, pitting, and crevice corrosion	Water chemistry, one-time inspection	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (see Section 3.3.2.2.1)
Linings in spent fuel pool cooling and cleanup system, seals and collars in ventilation systems (Item Number 3.3.1-02)	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant specific		Not applicable (see Section 3.3.2.2.2)
Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR) (Item Number 3.3.1-03)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components and Section 4.9, Reactor Building Crane Load Cycles
Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR) (Item Number 3.3.1-04)	Crack initiation and growth due to SCC or cracking	Plant specific		Not applicable (see Section 3.3.2.2.4)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components (Item Number 3.3.1-05)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant specific	Fire Protection Program (B2.1.17), Fire Water System Program (B2.1.18), One-Time Inspection Program (B2.1.23), System Condition Monitoring Program (B2.1.32)	Consistent with GALL, which recommends further evaluation (see Section 3.3.2.2.5)
Components in reactor coolant pump oil collect system of fire protection (Item Number 3.3.1-06)	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection		Not applicable (see Section 3.3.2.2.6)
Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system (Item Number 3.3.1-07)	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry, one-time inspection	Fuel Oil Chemistry Program (B2.1.20), One-Time Inspection Program (B2.1.23)	Consistent with GALL, which recommends further evaluation (see Section 3.3.2.2.7)
Piping, pump casing, and valve body and bonnets in shutdown cooling system (older BWR) (Item Number 3.3.1-08)	Loss of material due to pitting and crevice corrosion	Water chemistry, one-time inspection	Compressed Air Monitoring Program (B2.1.14), One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (see Section 3.3.2.2.1)
Heat exchangers in chemical and volume control system (Item Number 3.3.1-09)	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and a plant-specific verification program		Not applicable, PWR only
Neutron-absorbing sheets in spent fuel storage racks (Item Number 3.3.1-10)	Reduction of neutron-absorbing capacity and loss of material due to general corrosion (boral, boron steel)	Plant specific	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (see Section 3.3.2.2.10)
New fuel rack assembly (Item Number 3.3.1-11)	Loss of material due to general, pitting, and crevice corrosion	Structures monitoring	None	Not applicable

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Neutron-absorbing sheets in spent fuel storage racks (Item Number 3.3.1-12)	Reduction of neutron-absorbing capacity due to Boraflex degradation	Boraflex monitoring		Not applicable; Boraflex is not used at MNGP
Spent fuel storage racks and valves in spent fuel pool cooling and cleanup (Item Number 3.3.1-13)	Crack initiation and growth due to stress corrosion cracking	Water chemistry	Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Closure bolting and external surfaces of carbon steel and low-alloy steel components (Item Number 3.3.1-14)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable. Loss of material due to boric acid corrosion is not applicable since MNGP is a BWR-type facility that does not use boric acid
Components in or serviced by closed-cycle cooling water system (Item Number 3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Closed-cycle cooling water system	Closed-Cycle Cooling Water System Program (B2.1.13), One-Time Inspection Program (B2.1.23)	Consistent with GALL Report, which recommends no further evaluation
Cranes including bridge and trolleys and rail system in load handling system (Item Number 3.3.1-16)	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B2.1.22)	Consistent with GALL Report, which recommends no further evaluation
Components in or serviced by open-cycle cooling water systems (Item Number 3.3.1-17)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	One-Time Inspection Program (B2.1.23), Open-Cycle Cooling Water System Program (B2.1.24)	Consistent with GALL Report, which recommends no further evaluation
Buried piping and fittings (Item Number 3.3.1-18)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	Bolting Integrity Program (B2.1.4), Buried Piping & Tanks Inspection Program (B2.1.5)	Consistent with GALL Report, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in compressed air system (Item Number 3.3.1-19)	Loss of material due to general and pitting corrosion	Compressed air monitoring	Compressed Air Monitoring Program (B2.1.14)	Consistent with GALL Report, which recommends no further evaluation
Components (doors and barrier penetration seals) and concrete structures in fire protection (Item Number 3.3.1-20)	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	Fire Protection Program (B2.1.17)	Consistent with GALL Report, which recommends no further evaluation
Components in water-based fire protection (Item Number 3.3.1-21)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling	Fire water system	Fire Protection Program (B2.1.17), Fire Water System Program (B2.1.18)	Consistent with GALL Report (see Section 3.3.2.1.1)
Components in diesel fire system (Item Number 3.3.1-22)	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection, fuel oil chemistry	Fire Protection Program (B2.1.17), Fuel Oil Chemistry Program (B2.1.20), One-Time Inspection Program (B2.1.23)	This line item was not used at MNGP. The Fire Protection Program is applied to those components in the fire system associated with the diesel fire pump, with the exception of the diesel engine fuel oil supply. Components in the diesel engine fuel oil supply are included in the emergency diesel generators system, and the aging effect is managed by the Fuel Oil Chemistry and One-Time Inspection Programs
Tanks in diesel fuel oil system (Item Number 3.3.1-23)	Loss of material due to general, pitting, and crevice corrosion	Aboveground carbon steel tanks		Not applicable. MNGP does not have any above ground carbon steel tanks exposed to outdoor ambient conditions within the scope of license renewal

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Closure bolting (Item Number 3.3.1-24)	Loss of material due to general corrosion, crack initiation and growth due to cyclic loading and SCC	Bolting integrity	Bolting Integrity Program (B2.1.4)	Consistent with GALL Report, which recommends no further evaluation
Components in contact with sodium pentaborate solution in standby liquid control system (BWR) (Item Number 3.3.1-25)	Crack initiation and growth due to SCC	Water chemistry		Not applicable. At MNGP, the components exposed to sodium pentaborate solution are in an environment such that the components are not susceptible to SCC
Components in reactor water cleanup system (Item Number 3.3.1-26)	Crack initiation and growth due to SCC and IGSCC	Reactor water cleanup system inspection	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Components in shutdown cooling system (older BWR) (Item Number 3.3.1-27)	Crack initiation and growth due to SCC	BWR stress corrosion cracking and water chemistry	BWR Stress Corrosion Cracking Program (B2.1.10), Closed-Cycle Cooling Water System Program (B2.1.13), One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends no further evaluation
Components in shutdown cooling system (older BWR) (Item Number 3.3.1-28)	Loss of material due to pitting and crevice corrosion, and MIC	Closed-cycle cooling water system		Not applicable
Components (aluminum bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink (Item Number 3.3.1-29)	Loss of material due to selective leaching	Selective leaching of materials	Selective Leaching of Materials Program (B2.1.30)	Consistent with GALL Report, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Fire barriers, walls, ceilings, and floors in fire protection (Item Number 3.3.1-30)	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel	Fire protection, structures monitoring	Fire Protection Program (B2.1.17), Structures Monitoring Program (B2.1.31)	Consistent with GALL Report, which recommends no further evaluation

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in SER Section 3.3.2.1, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in SER Section 3.3.2.2, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.3.2.3, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are not consistent with, or not addressed in, the GALL Report. SER Section 3.0.3 documents the staff's review of AMPs that are credited to manage or monitor aging effects of the auxiliary systems components.

3.3.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.3.2.1, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the auxiliary systems components:

- Bolting Integrity Program (B2.1.4)
- Buried Piping & Tanks Inspection Program (B2.1.5)
- BWR Stress Corrosion Cracking Program (B2.1.10)
- Closed-Cycle Cooling Water System Program (B2.1.13)
- Compressed Air Monitoring Program (B2.1.14)
- Fire Protection Program (B2.1.17)
- Fire Water System Program (B2.1.18)
- Flow-Accelerated Corrosion Program (B2.1.19)
- Fuel Oil Chemistry Program (B2.1.20)
- One-Time Inspection Program (B2.1.23)
- Open-Cycle Cooling Water System Program (B2.1.24)
- Plant Chemistry Program (B2.1.25)
- Selective Leaching of Materials Program (B2.1.30)
- System Condition Monitoring Program (B2.1.32)

Staff Evaluation. In LRA Tables 3.3.2-1 through 3.3.2-18, the applicant summarized the AMRs for the auxiliary systems components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the GALL Report evaluation bounds the plant-specific components contained in these GALL Report component groups.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component is applicable to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component applies to the component under review. The staff verified whether it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but the applicant credited a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP will manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs. The following sections discuss the staff's evaluation.

3.3.2.1.1 Loss of Material for Components in Water-Based Fire Protection

In the discussion section of LRA Table 3.3.1, Item 3.3.1-21, the applicant stated the following:

> Loss of material due to general, pitting, crevice, galvanic corrosion, and MIC as well as heat transfer degradation due to fouling for components in the fire system are managed by the Fire Protection and Fire Water System Programs. The Fire Water System Program is applied for the majority of the components in the fire system. The Fire Protection Program is applied to those components in the fire system associated with the diesel fire pump with the exception of the diesel fire pump diesel engine fuel oil supply. In addition, the Fire Protection Program is applied to non-water-based fire protection subsystems such as Halon. Exceptions apply to NUREG-1801 recommendations for Fire Protection Program implementation. Implementation of the Fire Water System and Fire Protection Programs to manage the aging effect provides added assurance that the aging effect is not occurring; or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

In RAI 3.3.2.1.9-3, the staff noted that in LRA Table 3.3.2-9 for FIR, the applicant credited the Fire Protection Program with managing loss of material due to general, pitting, crevice, and galvanic corrosion, and MIC for copper alloy, and loss of material due to general and galvanic corrosion for gray cast iron material in a raw water environment, referring to GALL Report item VII.G6-b, which evaluates filter, fire hydrant, mulsifier, pump casing, sprinkler, strainer, and valve bodies from various materials including cast iron, bronze, and copper. The GALL Report also recommends the Fire Water System Program for managing this aging effect. The applicant referenced Note E, which indicates that a different AMP, Fire Protection Program, is used. As stated above, the applicant, in Table 3.3-1, Item 3.3.1-21, indicated that it applies the Fire Protection Program to nonwater-based fire protection systems. This indication conflicts with the Table 3.3.2-9 line items. Furthermore, the LRA does not identify in the program description how the Fire Protection Program will manage this aging effect in water-based systems.

Therefore, the staff requested that the applicant clarify how the Fire Protection Program will manage loss of material due to general, pitting, crevice, and galvanic corrosion in water-based FP systems.

In its response, dated November 22, 2005, the applicant stated the following:

> Although the LRA does not expressly identify how the Fire Protection Program will manage loss of material in water-based subsystems (i.e., diesel fire pump) in the Program Description of Appendix B, this is specifically addressed in the Fire Protection AMP Program Basis Document (PBD). Under the heading 'Diesel-Driven Fire Pump,' the PBD states that the water initiated aging effects

will be managed by the Fire Water System AMP. Therefore, the Fire Protection Program invokes the Fire Water System Program to manage loss of material due to crevice, galvanic, general and pitting corrosion in the water-based subsystem for the diesel fire pump. This is confirmed in the Fire Water System PBD.

As a result, the Fire Protection AMP will adequately manage the effect of loss of material due to crevice, galvanic, general and pitting corrosion for these components in the Fire System by invoking the Fire Water System AMP for the water initiated aging effects related to the diesel fire pump water-based subsystem.

The applicant's response also stated, "Although the Fire Water System AMP is credited in the license renewal database for managing the aging effect of loss of material for copper alloy filters and strainers in a raw water environment, it was inadvertently omitted from LRA Table 3.3.2-9. The Fire Water System AMP is credited for managing these components in the water-based portion of the Fire System."

The applicant agreed to revise the Fire Protection Program in the LRA to specifically address how it intends to credit the Fire Water System Program with managing loss of material in water-based subsystems. The applicant will also provide revised AMR line items to correct the inadvertent omission of the Fire Water System Program for managing the aging effect of loss of material for copper alloy filters and strainers in a raw water environment.

In its letter dated February 28, 2006, the applicant provided an update to LRA Table 3.3.2-9, adding the Fire Water System Program to the Fire Protection Program for managing the aging effect of loss of material for copper alloy filters and strainers in a raw water environment. In addition, the applicant amended the program description of the Fire Protection Program to invoke the Fire Water System Program for water-initiated aging effects related to the diesel fire pump water-based subsystem. Because the Fire Protection Program credits the Fire Water System Program for managing the aging effects of loss of material in water-based subsystems, the staff found the applicant's response acceptable. Therefore, the staff's concern described in RAI 3.3.2.1.9-3 is resolved.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. The staff's review concluded that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report; therefore, the staff concluded that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application. In LRA Section 3.3.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the auxiliary systems components. The applicant provided information concerning how it will manage the following aging effects:

- loss of material due to general, pitting, and crevice corrosion
- hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear
- cumulative fatigue damage
- crack initiation and growth due to cracking or stress corrosion cracking
- loss of material due to general, microbiologically influenced, pitting, and crevice corrosion
- loss of material due to general, galvanic, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and biofouling
- crack initiation and growth due to stress corrosion cracking and cyclic loading
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.3.2.2 of the SRP-LR. The staff's audit and review report details the staff's audit. The following sections discuss the staff's evaluation of the aging effects.

3.3.2.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Sections 3.3.2.2.1.1 and 3.3.2.2.1.2 against the criteria in SRP-LR Section 3.3.2.2.1.

In LRA Section 3.3.2.2.1.1, the applicant addressed loss of material due to general, pitting, and crevice corrosion of heat exchanger components in the auxiliary systems.

SRP-LR Section 3.3.2.2.1.1 states the following:

> Loss of material due to general, pitting, and crevice corrosion could occur in the channel head and access cover, tubes, and tubesheets of the heat exchanger in the spent fuel pool cooling and cleanup (system). The Water Chemistry program relies on monitoring and control of reactor water chemistry based on EPRI guidelines of BWRVIP-29 (TR-103515) for water chemistry in BWRs to manage the effects of loss of material from general, pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore,

verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the Water Chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In LRA Section 3.3.2.2.1.1, the applicant stated that the One-Time Inspection Program is applied in combination with the Plant Chemistry Program. The scope of this new AMP includes activities to verify the effectiveness of the Plant Chemistry Program, including a sample of components where the flow of water is low, or stagnant conditions exist. Implementation of the One-Time Inspection Program and the Plant Chemistry Program to manage the aging effect adds assurance that the aging effect does not occur or progresses very slowly, such that the component's intended function will be maintained during the period of extended operation. The applicant stated that in some cases in which the Plant Chemistry Program is not a viable option and aging effects/mechanisms are not expected to be significant, the One-Time Inspection Program alone is credited with managing aging effects.

The staff's review determined that the applicant's Plant Chemistry Program exceptions are nontechnical; the program is based on a more recent EPRI document for BWR water chemistry instead of the EPRI document recommended in the GALL Report, BWRVIP-29. The staff determined that the use of a more recent issue of the BWRVIP chemistry program document is acceptable. The staff determined that the use of the One-Time Inspection Program alone is acceptable in certain cases, such as no-flow conditions, in which the Plant Chemistry Program is not a viable option. These AMPs are appropriate for the aging effects/mechanisms identified and assure effective management through the period of extended operation. The staff reviewed the Plant Chemistry Program and the One-Time Inspection Program and found them acceptable for managing aging degradation. SER Sections 3.0.3.2.19 and 3.0.3.1.4, respectively, document the evaluations.

In LRA Section 3.3.2.2.1.2, the applicant addressed loss of material due to pitting and crevice corrosion of components in the auxiliary systems.

SRP-LR Section 3.3.2.2.1.2 states the following:

Loss of material due to pitting and crevice corrosion could occur in the piping, filter housing, valve bodies, and shell and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system. The Water Chemistry program relies on monitoring and control of reactor water chemistry based on EPRI guidelines of BWRVIP-29 (TR-103515) for water chemistry in BWRs to manage the effects of loss of material from pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the Water Chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In LRA Section 3.3.2.2.1.2, the applicant stated that the One-Time Inspection Program, the combination of the One-Time Inspection Program and the Plant Chemistry Program, or the Compressed Air Monitoring Program manages the loss of material due to pitting and crevice corrosion of these components. The scope of the One-Time Inspection Program incorporates activities to verify the effectiveness of the Plant Chemistry Program, including a sample of components where the water flow is low or stagnant conditions exist. Implementation of the One-Time Inspection Program and the Plant Chemistry Program to manage the aging effect adds assurance that the aging effect does not occur or progresses very slowly such that the component's intended function will be maintained during the period of extended operation. In some cases in which the Plant Chemistry Program is not a viable option and aging effects/mechanisms are not expected to be significant, the One-Time Inspection Program alone is credited with managing aging effects. The Compressed Air Monitoring Program is used to manage loss of material of stainless steel valve bodies of the AIR system in an air/gas environment (the applicant conservatively treats components with a "wet air/gas" environment in the same manner as treated water). The scope of the Compressed Air Monitoring Program includes procedurally required testing for water vapor, oil content, and particulate to ensure that instrument air quality does not have unacceptable levels of contaminants. In addition, external visual inspections of the AIR systems check once per cycle for corrosion and system pressure boundary degradation.

The staff's review determined that the applicant's Plant Chemistry Program exceptions are nontechnical and that the program is based on a more recent EPRI document for BWR water chemistry instead of the EPRI document recommended by the GALL Report, BWRVIP-29. The staff determined that the use of the One-Time Inspection Program alone is acceptable in certain cases, such as no flow conditions, in which the use of the Plant Chemistry Program is not a viable option. The Compressed Air Monitoring Program includes procedurally required testing for water vapor, oil content, and particulate to ensure that instrument air quality does not have unacceptable levels of contaminants. In addition, external visual inspections of the AIR systems check once per cycle for corrosion and system pressure boundary degradation. Engineering personnel must conduct a system walkdown and look for vibrating piping, leaks, or other indications of pending failures. These AMPs are appropriate for the aging effects/mechanisms identified and assure effective management through the period of extended operation. The staff reviewed the Plant Chemistry Program, the One-Time Inspection Program, and the Compressed Air Monitoring Program and found them acceptable for managing aging degradation. SER Sections 3.0.3.2.19, 3.0.3.1.4, and 3.0.3.2.13, respectively, document the evaluations.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.1. For those line items that apply to LRA Sections 3.3.2.2.1.1 and 3.3.2.2.1.2, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.2 Hardening and Cracking or Loss of Strength Due to Elastomer Degradation or Loss of Material Due to Wear

The staff reviewed LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2.

In LRA Section 3.3.2.2.2, the applicant addressed hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear in the auxiliary systems.

SRP-LR Section 3.3.2.2.2 states the following:

> Hardening and cracking due to elastomer degradation could occur in elastomer linings of the filter, valve, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR). Hardening and loss of strength due to elastomer degradation could occur in the collars and seals of the duct and in the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating ventilation systems and in the collars and seals of the duct in the diesel generator building ventilation system. Loss of material due to wear could occur in the collars and seals of the duct in the ventilation systems. The GALL report recommends further evaluation to ensure that these aging effects are adequately managed.

In LRA Section 3.3.2.2.2, the applicant stated that elastomer (e.g., neoprene, rubber) components are indoors and not subject to ultraviolet (UV) radiation, ozone, or significant radiation exposure. In addition, they are not subject to temperatures where change in material properties or cracking could occur. Therefore, the applicant claims that aging management is not required.

The applicant provided a detailed discussion of the technical basis for determining that aging management is not required in response to RAI 3.2.2.3-3, dated August 16, 2005. SER Section 3.3.2.3 documents the discussion and the staff's evaluation.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.2. For those line items that apply to LRA Section 3.3.2.2.2, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.3 Cumulative Fatigue Damage

In LRA Section 3.3.2.2.3, the applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Sections 4.3 and 4.9 document the staff's review of the applicant's evaluation of this TLAA for mechanical auxiliary systems and the reactor building crane, respectively.

3.3.2.2.4 Crack Initiation and Growth Due to Cracking or Stress-Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4.

In LRA Section 3.3.2.2.4, the applicant addressed cracking for heat exchangers in the RWCU system.

SRP-LR Section 3.3.2.2.4 states the following:

> Crack initiation and growth due to SCC could occur in the regenerative and non-regenerative heat exchanger components in the reactor water cleanup system of BWR plants. The GALL Report recommends further evaluation to ensure that these aging effects are managed adequately.

In LRA Section 3.3.2.2.4, the applicant stated that cracking due to SCC does not apply to its RWCU system heat exchangers. Industry operating experience shows that for carbon steel RWCU system heat exchanger components within the scope of license renewal in a treated water environment, crack initiation and growth does not occur and no aging management is required.

The staff's review determined that the applicant's assessment that SCC does not apply to the carbon steel shell is acceptable; therefore, the staff concluded that the applicant's further evaluation is acceptable because SRP-LR Section 3.3.2.2.4 does not apply.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.4. For those line items that apply to LRA Section 3.3.2.2.4, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.5 Loss of Material Due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5.

In LRA Section 3.3.2.2.5, the applicant addressed loss of material due to general, pitting, and crevice corrosion and MIC of mechanical components in the auxiliary systems.

SRP-LR Section 3.3.2.2.5 states the following:

> Loss of material due to general, microbiologically influenced, pitting, and crevice corrosion could occur in the piping and filter housing and supports in the control room area, the auxiliary and radwaste area, the primary containment heating and ventilation systems, in the piping of the diesel generator building ventilation system, in the above ground piping, and fittings, valves, and pumps in the diesel fuel oil system and in the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the EDG system. Loss of material due to general, pitting, crevice and microbiologically influenced corrosion could occur in the duct fittings, access doors, and closure bolts, equipment frames and housing of the duct, due to pitting and crevice corrosion could occur in the heating/cooling coils of the air handler heating/cooling, and due to general corrosion could occur on the external surfaces of all carbon steel structures and

components, including bolting exposed to operating temperatures less than 212 °F in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

In LRA Section 3.3.2.2.5, the applicant stated that loss of material due to corrosion of mechanical components could occur on surfaces exposed to air/gas under a range of atmospheric conditions. For the internal surfaces of mechanical components in the EDGs, emergency filtration train, and HTV systems, the One-Time Inspection Program is credited with managing the aging effect. For the external surfaces of mechanical components in all auxiliary systems, the applicant credits the Fire Water System Program, Fire Protection Program, System Condition Monitoring Program, and/or One-Time Inspection Program with managing the aging effect.

The staff's review determined that the applicant's Fire Water System Program and the Fire Protection Program together manage aging effects in the water-based FP system piping and components in accordance with applicable NFPA recommendations and aging effects for components in the FIR, including components for the diesel fire pump. The staff also reviewed the System Condition Monitoring Program and determined that this existing plant-specific AMP manages aging effects for normally accessible external surfaces of piping, tanks, and other components and equipment within the scope of license renewal. The applicant manages these aging effects through visual inspection and monitoring of external surfaces for leakage and evidence of material degradation. The staff's review also determined that the One-Time Inspection Program includes a sample of components in which flow is low or stagnant conditions exist. Implementation of the One-Time Inspection Program adds assurance that the aging effect does not occur or progresses very slowly, such that the component's intended function will be maintained during the period of extended operation. The staff reviewed the applicant's Fire Water System Program, the Fire Protection Program, the One-Time Inspection Program, and the System Condition Monitoring Program and found them acceptable for managing aging degradation. SER Sections 3.0.3.2.16, 3.0.3.2.15, 3.0.3.1.4, and 3.0.3.3.2, respectively, document the evaluations. These AMPs are appropriate for the aging effects/mechanisms identified and assure effective management of aging effects through the period of extended operation.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.5. For those line items that apply to LRA Section 3.3.2.2.5, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 Loss of Material Due to General, Galvanic, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6.

In LRA Section 3.2.2.2.6, the applicant addressed loss of material due to general, galvanic, pitting, and crevice corrosion for components in the reactor coolant pump (RCP) oil collection system for FP.

SRP-LR Section 3.2.2.2.6 states the following:

> Loss of material due to general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collection system in fire protection. The Fire Protection program relies on a combination of visual and volumetric examinations in accordance with the guidelines of 10 CFR Part 50 Appendix R and Branch Technical Position 9.5-1 to manage loss of material from corrosion. However, corrosion may occur at locations where water from wash downs may accumulate. Therefore, verification of the effectiveness of the program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, galvanic, pitting, and crevice corrosion to verify the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the tank of the reactor coolant pump oil collection system is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In LRA Section 3.3.2.2.6, the applicant stated that MNGP is not designed with an RCP (recirculation pump) oil collection system because these pumps are within the primary containment, which is inerted with nitrogen during normal operation.

On the basis of its review, the staff determined that the applicant has no components covered by SRP-LR Section 3.3.2.2.6. The staff found this aging effect not applicable.

3.3.2.2.7 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling

The staff reviewed LRA Section 3.3.2.2.7 against the criteria in SRP-LR Section 3.3.2.2.7.

In LRA Section 3.3.2.2.7, the applicant addressed loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling for components in the EDGs.

SRP-LR Section 3.3.2.2.7 states the following:

> Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur on the internal surface of tanks in the diesel fuel oil system and due to general, pitting, and crevice corrosion and MIC in the tanks of the diesel fuel oil system in the EDG system. The existing AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D4057, D1796, D2709 and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. Verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion/biofouling to verify the effectiveness of the program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In LRA Section 3.3.2.2.7, the applicant stated that its Fuel Oil Chemistry Program manages loss of material for all components wetted by fuel oil. The One-Time Inspection Program confirms the effectiveness of the Fuel Oil Chemistry Program. The Fuel Oil Chemistry Program uses existing diesel oil system procedures that encompass the GALL Report program requirements. The Fuel Oil Chemistry Program mitigates and manages aging effects on the surfaces wetted by fuel oil in fuel oil storage tanks and associated components, including the tank and other components supplying fuel to the diesel fire pump. The program includes (1) surveillance and monitoring procedures for maintaining fuel oil quality by controlling contaminants in accordance with applicable ASTM standards, (2) periodic draining of water from fuel oil tanks, (3) periodic or conditional visual inspection of internal surfaces or wall thickness measurements (e.g., by UT) from external surfaces of fuel oil tanks, and (4) one-time inspections of a representative sample of components in systems that contain fuel oil. The One-Time Inspection Program includes (1) determination of sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience, (2) identification of the inspection locations in the system or component based on the aging effect, (3) determination of the examination technique, including acceptance criteria that will be effective in managing the aging effect for which the component is examined; and (4) evaluation of the need for followup examinations to monitor the progression of any aging degradation.

The staff reviewed the applicant's Fuel Oil Chemistry Program and the One-Time Inspection Program and found them acceptable for managing aging degradation. SER Sections 3.0.3.2.17 and 3.0.3.1.4, respectively, document the evaluation.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.7. For those line items that apply to LRA Section 3.3.2.2.7, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 provides the staff's evaluation of the applicant's Quality Assurance Program.

3.3.2.2.9 Crack Initiation and Growth Due to Stress-Corrosion Cracking and Cyclic Loading

The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9.

In LRA Section 3.3.2.2.9, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.3.2.2.9 states that crack initiation and growth due to SCC and cyclic loading could occur in the channel head and access cover, tubesheet, tubes, shell and access cover, and closure bolting of the regenerative heat exchanger and in the channel head and access cover, tubesheet, and tubes of the letdown heat exchanger in the chemical and volume control system (CVCS). SRP-LR Table 3.3-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found this aging effect not applicable.

3.3.2.2.10 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10.

In LRA Section 3.3.2.2.10, the applicant addressed reduction of neutron-absorbing capacity and loss of material due to general corrosion for boral.

SRP-LR Section 3.3.2.2.10 states the following:

> Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

In LRA Section 3.3.2.2.10, the applicant stated that the Plant Chemistry Program manages the aging effects of loss of material and reduction of neutron-absorbing capacity of boral in a treated water environment due to crevice, galvanic, and pitting corrosion and MIC and the aging effect of cracking due to SCC by ensuring that corrosive ion concentrations do not exceed acceptable limits and by limiting the amount of impurities in the water. General corrosion does not apply as boral/aluminum develops a strongly bonded oxide film with excellent corrosion resistance. The One-Time Inspection Program will verify the effectiveness of the Plant Chemistry Program by confirming the absence of aging effects on boral coupon samples stored in the spent fuel pool. Aging effects that could affect rack integrity or neutron absorption characteristics are not expected because none have been observed during coupon sample evaluations conducted over the past 20 years. By letter dated November 17, 2005, the applicant stated that it will visually examine the unclad boral coupon sample before the period of extended operation. The applicant will remove the coupon from the spent fuel pool for a brief period of time, visually examine it, and then immediately return it to the spent fuel pool.

The staff's review determined that the Plant Chemistry Program, supplemented by the One-Time Inspection Program, will manage reduction of neutron-absorbing capacity and loss of material due to general corrosion. The one-time inspection of boral coupon test specimens will confirm that no significant aging degradation will occur and that the neutron-absorbing capability of the boral has not been reduced.

These AMPs are appropriate for the aging effects/mechanisms identified and assure effective management through the period of extended operation. The staff reviewed the Plant Chemistry Program and the One-Time Inspection Program and found them acceptable for managing aging degradation. SER Sections 3.0.3.2.19 and 3.0.3.1.4, respectively, document the evaluations.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.10. For those line items that apply to LRA Section 3.3.2.2.10, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The staff reviewed LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11.

In LRA Section 3.3.2.2.11, the applicant addressed loss of material due to general, pitting, and crevice corrosion and MIC of underground (buried) piping and fittings in the DGN, FIR, and ESW systems.

SRP-LR Section 3.3.2.2.11 states the following:

> Loss of material due to general, pitting, and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system (SW system) and in the diesel fuel oil system. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

In LRA Section 3.3.2.2.11, the applicant stated that the Buried Piping & Tanks Inspection Program manages the loss of material due to general, pitting, and crevice corrosion, MIC, galvanic corrosion, and selective leaching for buried valve bodies, piping, and fittings. The Bolting Integrity Program manages loss of material due to general, pitting, and crevice corrosion, MIC, and galvanic corrosion for buried fasteners. The Buried Piping & Tanks Inspection Program consists of preventive and condition monitoring measures to manage the aging effect. Preventive measures consist of protective coatings and/or wraps on buried components. Condition monitoring consists of periodic inspections of buried components. The applicant's operating experience shows no buried pipe/tank failures for components within the scope of license renewal. The Bolting Integrity Program consists of guidelines on materials selection, strength and hardness properties, installation procedures, lubricants and sealants, corrosion considerations in the selection and installation of pressure-retaining bolting for nuclear applications, and inspection techniques.

The staff's review determined that the Buried Piping & Tanks Inspection Program provides adequate management of aging effects for buried pipes, components, and tanks during the period of extended operation. The Bolting Integrity Program references and invokes the provisions of the Buried Piping & Tanks Inspection Program to implement inspection of these components. The staff reviewed the Buried Piping & Tanks Inspection Program and the Bolting Integrity Program and found them acceptable for managing aging degradation. SER Sections 3.0.3.2.5 and 3.0.3.2.4, respectively, document the evaluations.

On the basis of its review, the staff concluded that the applicant has met SRP-LR Section 3.3.2.2.11 criteria. For those line items that apply to LRA Section 3.3.2.2.11, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.3.2-1 through 3.3.2-18, the staff reviewed additional details of the results of the AMRs for material, environment, AERM, and AMP combinations that are not consistent with the GALL Report, or that are not addressed in the GALL Report.

In LRA Tables 3.3.2-1 through 3.3.2-18, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report and provided information concerning the management of the aging effect. Specifically, Note F indicates that the GALL Report does not evaluate the material for the AMR line item component. Note G indicates that the GALL Report does not evaluate the environment for the AMR line item component and material. Note H indicates that the GALL Report does not evaluate the aging effect for the AMR line item component, material, and environment combination. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination does not apply. Note J indicates that the GALL Report evaluates neither the component nor the material and environment combination for the line item.

Staff Evaluation. For component type, material, and environment combinations that the GALL Report does not evaluate, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB during the period of extended operation. This section addresses the AMR results for which LRA Tables 3.3.2-1 through 3.3.2-18 do not identify any aging effects. Each table discussion separately addresses other line items not consistent with or not addressed in the GALL Report. The following sections discuss the staff's evaluation.

The staff's review of LRA Tables 3.3.2-1 through 3.3.2-18 identified areas for which it needed additional information to complete its evaluation of the applicant's results. The applicant responded to the staff's general RAIs as discussed below.

In RAI 3.3.2.3-2, dated July 20, 2005, the staff noted that LRA Tables 3.3.2-6 and 3.3.2-8 identify heat transfer degradation due to fouling as an AERM for copper heat exchangers (heat transfer and pressure boundary functions) in a lubricating oil environment. The applicant credited the One-Time Inspection Program with managing this aging effect. The One-Time Inspection Program verifies the effectiveness of an AMP and confirms the absence of an aging effect. For fouling of heat exchangers in a lubricating oil environment, mitigation of the aging effect depends on a lubricating oil monitoring program to maintain the integrity of the oil; therefore, the staff requested that the applicant identify an AMP to mitigate the effects of fouling in the heat exchangers during the period of extended operation and verify the effectiveness of that program with a one-time inspection.

In its response, by letter dated August 16, 2005, the applicant stated the following:

> Table 3.3.2-6, Emergency Diesel Generators System (EDG) and Table 3.3.2-8, Emergency Service Water System (ESW) identify copper alloy heat exchanger tubes for both the EDG lube oil coolers and RHR Service Water (RSW) pump motor thrust bearing oil coolers, with lubricating oil as an external environment for these Auxiliary Systems.
>
> The NMC position concerning the potential aging effect of heat transfer degradation due to fouling in a lubricating oil environment is that degradation effects are insignificant for lubricating oil systems if the oil remains free of water and other contaminants. Under these conditions, lubricating oil systems and associated components have few, if any, significant aging effects. The purity of the EDG and ESW lubricating oil systems is maintained and chemically analyzed periodically. For equipment not normally in operation during power operation such as the EDG lube oil coolers and the RSW motor thrust bearing oil coolers, periodic testing of the equipment, in conjunction with oil sampling, is performed to detect any contaminants or water in the oil.
>
> Lubricating oil is usually non-corrosive and flow rates for lube oil systems are typically low. Strict controls for the quality and purity of the lubricating oil procured and scheduled sampling techniques and parameters monitored are requirements of the MNGP lubricating oil sampling procedures. Very little corrosion occurs in lubricating oil systems due to low oxygen content, the fact that lubricating oils are not good electrolytes and purification systems are generally installed and/or corrosion inhibitors added to maintain the lubricating oil free of corrosion products.
>
> Lube oil samples for the EDG lube oil coolers are obtained quarterly and samples for the RSW pump motor thrust bearing oil coolers are obtained annually in accordance with MNGP site procedures. The sample results are evaluated and trended for these components. Any indication of an anomalous condition or adverse trend will result in an investigation under the site corrective action program. All sample results have been acceptable to date to ensure that the lubricating oil remains free of moisture and contaminants that could potentially degrade the heat exchanger tubes, with the last samples taken and evaluated for both the EDG and ESW systems in 2005. Although MNGP operating experience did result in the replacement of the EDG lube oil coolers due to the lead solder joints and resultant exfoliation corrosion, this was a design issue and not age-related (Institute of Nuclear Power Operations SOER 80-04).
>
> Based on the above procurement and sampling requirements to maintain the integrity of the lubricating oil and MNGP plant-specific operating experience that confirms the absence of this aging effect, MNGP conservatively credits the One-Time Inspection Program to verify the absence of the aging effect of heat transfer degradation due to fouling for these components in the EDG and ESW

Systems. The MNGP One-Time Inspection Program will use the Corrective Action Program to evaluate indications or relevant conditions of degradation. The need to increase the number of selected components for inspection will also be evaluated when indications or relevant conditions of degradation or unacceptable conditions are found.

Based on its review, the staff found the applicant's response to RAI 3.3.2.3-2 acceptable, because the applicant satisfactorily identified procurement and sampling requirements to maintain the integrity of the lubricating oil and use of the One-Time Inspection Program to verify the absence of the aging effect of heat transfer degradation due to fouling in the DGN and ESW system heat exchangers; therefore, the staff's concern described in RAI 3.3.2.3-2 is resolved.

In RAI 3.3.2.3-3, dated July 20, 2005, the staff noted that LRA Tables 3.3.2-3 and 3.3.2-16 identify no aging effects for rubber expansion joints in a raw water environment; therefore, the staff requested that the applicant identify an AMP to manage hardening and loss of strength for rubber expansion joints in a raw water environment.

In its response, by letter dated August 16, 2005, the applicant stated the following:

> Several EPRI Technical Reports and Industry handbooks were reviewed for aging of elastomers. A summary of the review is provided below.
>
> EPRI Report 1008035, 'Expansion Joint Maintenance Guide', Revision 1, May 2003, Table 5-4, rates elastomers against oxidation, tensile strength, and radiation. Elastomers, such as neoprene, natural rubber, Chlorobutyl, Buna-N, viton, and EPDM, are rated as good or better in the categories of oxidation, tensile strength, and radiation.
>
> EPRI Report NP-6608, 'Shelf Life of Elastomeric Components,' May 1994, Appendix A, provides curves that describe the change in physical properties for different elastomers as they undergo natural aging. The figures demonstrate that there is very little change in the hardness and tensile strength of elastomers over a 33 year period.
>
> EPRI Report NP-6408, 'Guidelines for Establishing, Maintaining, and Extending the Shelf Life Capability of Limited Life Items (NCIG-13)', May 1992, section 4.3.2, states that test results demonstrated Viton and Neoprene as having excellent weather resistance and are therefore UV resistant. Section 4.4.2 states that these elastomers are also highly resistant to ozone.
>
> The Parker O-Ring Handbook, Page 2-24, in a discussion about aging of rubber seals states, 'It is environment and not age that is significant to seal life, both in storage and actual service.' The following is a discussion of the role of environment on the aging of elastomers.
>
> EPRI 1003056, November 2001, 'Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 3, states 'For a complete discussion of the aging effects of typical elastomers used in nuclear plants, the applicant is

referred to EPRI TR-114881, 'Aging Effects for Structures and Structural Components (Structural Tools)'. EPRI TR-114881 has been superceded by EPRI 1002950, 'Aging Effects for Structures and Structural Components (Structural Tools), Revision 1', May 2003. This report discusses the three stressors: (1) Ultraviolet, (2) Thermal, and (3) Radiation listed below.

(1) Ultraviolet: The Structural Tools state 'Rubber is decomposed by exposure to ultraviolet radiation. Ultraviolet radiation sources at nuclear plants include solar radiation and ultraviolet or fluorescent lamps. The deterioration of rubber is greatly accelerated in the presence of oxygen. Cracking and checking (splitting), which may occur when rubber is exposed to air and sunlight, are due mainly to reaction with ozone.' None of the elastomers in the scope of license renewal at MNGP are exposed to solar radiation. EPRI Report NP-6408, Section 4.3.2, states that UV on elastomers caused by artificial light is of little concern since the amount of UV is very small. For conservatism, MNGP took the position that any elastomers in close proximity to fluorescent lamps would be managed for aging, however none were found. Therefore, given the absence of solar radiation and the negligible effects from artificial light, these elastomers are not susceptible to hardening and loss of strength, which could be caused by the ultraviolet radiation exposure.

(2) Thermal: The Structural Tools state, 'In general, if the ambient temperature is less than about 95°F, then thermal aging may be considered not significant for the period of extended operation'. Since these elastomers are not exposed to temperatures >95 degrees F, they are therefore not susceptible to hardening and loss of strength caused by thermal exposure.

(3) Radiation: The Structural Tools state, 'Material property changes and cracking owing to radiation is an applicable aging effect for rubber, neoprene, and silicone elastomers in environments where the radiation exceeds the limits defined above.' The limit listed for rubber is 10^7 Rads, Butyl Rubber 10^6 Rads, and Neoprene 10^6 Rads. Since these elastomers are not exposed to this degree of ionizing radiation exposure, which is orders of magnitude above that corresponding to 60 years of normal plant operation, they are therefore not susceptible to hardening and loss of strength caused by radiation.

EPRI 1002950, 'Structural Tools,' reviewed industry failure data and NRC generic communications to determine if there was any additional aging effects that should be considered for elastomers. The review did not uncover any new aging effects.

EPRI Report 1007933, 'Aging Assessment Field Guide,' December 2003, pages 60 through 65, lists degradation mechanisms brought on by the stressors: Thermal, Radiation, and Ultraviolet. Since these elastomers are not exposed to ultraviolet, radiation, or temperatures >95°F, they are therefore not susceptible to hardening and loss of strength and therefore no aging management is required.

Consistent with the above discussion, Monticello only included elastomers in an aging management program that are subject to elevated temperature, ultraviolet, or ionizing radiation. Elastomers are included in the One-Time Inspection Program to confirm that unacceptable degradation has not occurred such that they will perform their intended function during the period of extended operation. If inspections of these more severe applications identify unacceptable degradation, the inspection scope would be expanded as required by the One-Time Inspection Program. The expanded scope would include less environmentally severe applications and could eventually include the elastomers that were excluded from aging management as described above. Therefore, elastomers not explicitly identified as requiring aging management, based on industry experience and technical research, are subject to the One-Time Inspection Program requirements concerning scope expansion and could be inspected if needed based on the examination results of more severe applications.

By letter, dated November 17, 2005, the applicant described the following additional aging management for elastomers in an air environment exposed to ozone:

> After further evaluation of this issue, NMC has taken the conservative approach of managing change in material properties due to ozone for elastomers in an air environment, specifically for natural rubber. This is a result of the fact that neither representative ozone concentrations nor technically substantiated thresholds could be adequately or consistently determined, even though plant-specific operating experience has indicated that there has been no change in material properties due to ozone for these elastomer components. Further evaluation also revealed the inability to confirm that none of these components are fabricated from natural rubber.
>
> As a result, elastomers in an external air environment in the following LRA tables will utilize the System Condition Monitoring Program to manage the potential aging effect of change in material properties due to ozone which shall be assigned to these components.
>
> - Table 3.3.2-3 expansion joints in the Circulating Water System
> - Table 3.3.2-5 piping and fittings in the Demineralized Water System
> - Table 3.3.2-6 piping and fittings in the Emergency Diesel Generators System
> - Table 3.3.2-7 ventilation seals in the Emergency Filtration Train System
> - Table 3.3.2-16 expansion joints in the Service and Seal Water System
> - Table 3.4.2-2 expansion joints in the Condensate and Feedwater System (those which were not previously managed externally)
>
> Elastomers in Table 3.2.2-8 (ventilation seals in the Secondary Containment System) are presently being managed utilizing the One-Time Inspection Program for the internal surfaces and the System Condition Monitoring Program

for the external surfaces. These Aging Management Programs (AMPs) were initially credited to manage change in material properties and cracking due to thermal exposure, since a temperature threshold of greater than 95 °F was assigned to these components. Consequently, these same AMPs will also manage change in material properties due to ozone which shall be assigned to these components.

Elastomers (expansion joints) in Table 3.4.2-3 (Main Condenser System) do not require aging management since these components do not serve a pressure boundary intended function but provide for plate-out and holdup of radioactive material during design basis events. Condenser integrity is continuously demonstrated during normal plant operation thus validating that this intended function is maintained as stated in the plant-specific notes for these components in Section 3.4 of the LRA.

Elastomers in an internal air environment in Table 3.3.2-6 (piping and fittings in the Emergency Diesel Generators System) and Table 3.3.2-7 (ventilation seals in the Emergency Filtration Train System) will utilize the One-Time Inspection Program to manage the potential aging effect of change in material properties due to ozone which shall be assigned to these components.

Elastomers in both an internal and external air environment in Table 3.3.2-11 (ventilation seals in the Heating and Ventilation System) were inadvertently omitted from this table. These components shall be managed for the potential aging effect of change in material properties due to ozone utilizing the One-Time Inspection Program for the internal surfaces and the System Condition Monitoring Program for the external surfaces which shall be assigned to these components.

All the elastomers addressed are long-lived components. Any component that is not long-lived and replaced at specified intervals is eliminated from AMR consideration during the screening process. Although the expansion joints are presently under review for replacement on a fixed periodicity, this change has not been effected and they remain as and have been analyzed as long-lived components.

Any degradation of elastomer components in an air environment resulting from change in material properties due to ozone for the external surfaces of these components shall be evaluated as discussed in the response to RAI B2.1.32-2 which addresses the System Condition Monitoring AMP.

This response also applies to the previous RAI responses concerning elastomers including RAI 3.3.2.3-3, RAI 3.3.2.3-4, RAI 3.3.2.3-5, RAI 3.3.2.3-6, and RAI 3.4-01.

Based on its review, the staff found the applicant's response to RAI 3.3.2.3-3 acceptable, because it satisfactorily identified stressors and thresholds for which hardening and loss of strength are aging effects for elastomer components and applied aging management for these cases. Where the stressors and thresholds for which hardening and loss of strength are not exceeded, aging management is not required. Therefore, the staff's concern described in RAI 3.3.2.3-3 is resolved.

In RAI 3.3.2.3-4, dated July 20, 2005, the staff noted that LRA Tables 3.3.2-3, 3.3.2-5, 3.3.2-6, 3.3.2-7, and 3.3.2-16 identify no aging effects for rubber expansion joints, piping and fittings, and elastomer ventilation seals in a plant indoor air environment; therefore, the staff requested that the applicant identify an AMP to manage hardening and loss of strength for these rubber and elastomer components in a plant indoor air environment.

In its response, by letter dated August 16, 2005, the applicant stated that its response to RAI 3.3.2.3-3 applies to this RAI as well.

The staff found the applicant's response acceptable. Therefore, the staff's concern described in RAI 3.3.2.3-4 is resolved.

In RAI 3.3.2.3-5, dated July 20, 2005, the staff noted that LRA Tables 3.3.2-5 and 3.3.2-17 identify no aging effects for rubber accumulators, piping, and fittings in a treated water environment. Previously, the staff had identified hardening and loss of strength as aging effects for rubber and elastomer components in this environment and recommended a plant-specific program to manage these aging effects by periodic inspections of the components; therefore, the staff requested that the applicant identify an AMP to manage hardening and loss of strength for these rubber components in a treated water environment.

In its response, by letter dated August 16, 2005, the applicant referred to its response to RAI 3.3.2.3-3.

The staff found the applicant's response acceptable; therefore, the staff's concern described in RAI 3.3.2.3-5 is resolved.

In RAI 3.3.2.3-6, dated July 20, 2005, the staff noted that LRA Tables 3.3.2-6 and 3.3.2-7 identify no aging effects for rubber ventilation seals, piping, and fittings in a gas and air internal environment; therefore, the staff requested that the applicant identify an AMP to manage hardening and loss of strength for these rubber components in a gas and air internal environment where the internal temperature exceeds 95 °F.

In its response, by letter dated August 16, 2005, the applicant referred to its response to RAI 3.3.2.3-3.

The staff found the applicant's response acceptable; therefore, the staff's concern described in RAI 3.3.2.3-6 is resolved.

In RAI 3.3.2.3-7, dated July 20, 2005, the staff noted that LRA Tables 3.3.2-6 and 3.3.2-9 identify no aging effects for stainless steel fasteners/bolting and copper alloy flame arresters in an environment exposed to weather; therefore, the staff requested that the applicant identify an AMP to manage loss of material due to pitting and crevice corrosion for these stainless steel and copper alloy components exposed to weather.

In its response, by letter dated August 16, 2005, the applicant stated the following:

Table 3.3.2-6, Emergency Diesel Generators System (EDG) and Table 3.3.2-9, Fire System (FIR) identify stainless steel fasteners/bolting (EDG and FIR), copper alloy flame arrestors (EDG and FIR) and hose house supply valves (FIR) exposed to weather for these Auxiliary Systems. The NMC materials science position, which is in accordance with EPRI 1003056 (Non-Class I Mechanical Implementation Guideline and Mechanical Tools, Revision 3), is that these components do not have a surface exposed to an aggressive chemical species, do not have the potential for concentrating contaminants and are not subject to wetting other than their normal environment. Therefore, loss of material due to crevice or pitting corrosion is not a potential aging mechanism.

Crevice corrosion is a potential aging mechanism for wetted stainless steel and high zinc copper alloys under certain conditions. Crevice corrosion is strongly dependent on the presence of dissolved oxygen. Although oxygen depletion in crevices may occur as a result of the corrosion process, oxygen is still required for the onset of corrosion, and a bulk fluid oxygen content or the presence of contaminants such as chlorides is necessary for the continued dissolution of material in the crevice. For systems with extremely low oxygen content (<0.1 ppm), crevice corrosion is considered insignificant. This form of corrosion requires a crevice where contaminants and corrosion products can concentrate. In addition to oxygen, moisture is required for the mechanism to operate. Alternate wetting and drying is particularly harmful as this leads to a concentration of atmospheric pollutants and contaminants if they are present. These conditions do not exist at the MNGP.

Pitting corrosion is a potential aging mechanism for wetted stainless steel and high zinc copper alloys under certain conditions. Unless cupric, ferric or mercuric halides are present in the environment, oxygen is required for pitting initiation. Areas where aggressive species can concentrate are particularly susceptible to pitting. Most pitting is the result of halide contamination, with chlorides, bromides, and hypochlorites being prevalent. Pitting is a significant aging effect for stainless steels and high zinc copper alloys when exposed to a corrosive environment. Any continuously wetted or alternately wetted and dried surfaces tend to concentrate aggressive species if they are present and are prone to pitting corrosion. These conditions also do not exist at the MNGP.

For conservatism, the stainless steel fastener/bolting component was added as a 'global' asset to assure no components, materials or environments were inadvertently omitted during the AMR process. Recent walk downs of both the EDG and FIR Systems revealed there were no stainless steel fasteners/bolting exposed to weather in either of these systems. Additionally, the FIR hose house supply valves reside within the individual hose house metal enclosures. Although these copper alloy valves are subjected to an 'Outside Air Protected from Weather' environment, they were conservatively assigned to the 'Exposed to Weather' environment. Sheltered environments tend to preclude the presence of sufficient moisture to promote significant corrosion. Lastly, the copper alloy flame arrestors, though painted (no credit is taken for coatings at MNGP with respect to the mechanical systems), were confirmed to be aluminum during these walk downs. Since aluminum and copper alloys are analyzed essentially in the same manner for loss of material due to crevice and pitting corrosion in an 'exposed to weather' external environment, the difference in actual material is considered inconsequential. However, both the EDG and FIR Systems' stainless steel fasteners/bolting exposed to weather asset shall be removed from Table 3.3.2-6 and Table 3.3.2-9 and the material for the flame arrestors shall be changed from copper alloy to aluminum in Table 3.3.2-6.

Since none of these components have a surface exposed to an aggressive chemical species (sulfur dioxide, chlorine gases, sulfur gases, ozone, etc.), do not have the potential for concentrating contaminants and are not subject to wetting other than their normal environment, loss of material due to crevice or pitting corrosion is not a potential aging mechanism. This has been confirmed by system walk downs and substantiated by plant-specific operating experience.

Based on its review, the staff found the applicant's response to RAI 3.3.2.3-7 acceptable because (1) no stainless steel fasteners/bolting in the DGN and FIR system are exposed to weather and (2) the aluminum flame arrestors in Table 3.3.2-6 and the copper alloy hose house supply valves in Table 3.3.2-9 are not subject to environments that promote pitting and crevice corrosion. Therefore, aging management is not required for these components and the staff's concern described in RAI 3.3.2.3-7 is resolved.

In LRA Tables 3.3.2-1 through 3.3.2-18, the applicant identified line items for which it did not identify any aging effects as a result of the aging review process.

Specifically, the applicant stated that no aging effects occur when components fabricated from bronze, CASS, copper alloy, and stainless steel materials are exposed to air/gas (internal and external), concrete (external), dry air (internal), gas-halon (internal), gas-instrument air (internal), gas-nitrogen (internal), gas-refrigerant (internal), lubricating oil (internal and external), plant indoor air (internal and external), and primary containment air (external) environments. In addition, components fabricated from carbon steel, galvanized steel, and cast iron exposed to these same environments, with the exception of indoor air and primary containment air environments, have no aging effects. The applicant stated that materials science evaluation of these materials in such environments found no aging effects for the components and materials. No aging effects are considered applicable to components fabricated from the above list of materials exposed to the given environments.

As shown in the *Metals Handbook*, Ninth Edition, Volume 13, comprehensive tests over a 20-year period under ASTM supervision confirmed the suitability of copper alloys for atmospheric exposure. Additionally, because the gaseous internal environments to which components within the scope of license renewal may be subject include air, nitrogen, carbon dioxide, freon, and halon, industry experience shows that copper piping exposed to an internal gaseous environment will be resistant to any age-related degradation; therefore, the SC will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

As shown in the *Metals Handbook*, Ninth Edition, Volumes 1 and 13, both oxygen and moisture must be present to corrode steel. Experience has shown that general corrosion of steel (including carbon steel, alloy steel, gray cast iron, and galvanized steel) will apply only if it were exposed to outdoor or indoor environments that promote condensation of water on the external surfaces of components; therefore, the SC will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

As shown in *Metals Handbook*, Ninth Edition, Volumes 3 and 13, stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species (which will be reflective of indoor uncontrolled air or primary containment air inerted with nitrogen); therefore, the SC will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

As shown in the *Metals Handbook*, Ninth Edition, Volumes 1 and 13, both oxygen and moisture must be present to corrode steel. Components are not subject to wetting if their surfaces remain oil-coated; therefore, steel (carbon or stainless) in a lubricating oil environment with no water pooling exhibits no aging effect, and the SC will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

For carbon steel embedded in concrete, loss of material due to general corrosion could occur in an aggressive environment. An aggressive environment has pH less than 5.5, chlorides greater than 500 ppm, or sulfates greater than 1500 ppm. Plant documents confirm that the below-grade environment is not aggressive. The applicant's data indicate that the pH exceeds 7, chlorides are less than 100 ppm, and sulfates are less than 100 ppm. To ensure that the below-grade environment remains nonaggressive, the Structures Monitoring Program includes periodic monitoring of ground water chemistry for the above parameters; therefore, the SC will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

The staff's review of current industry research and operating experience found that effects of the listed environments on the given materials will not result in aging effects of concern during the period of extended operation; therefore, the staff concluded that no AERMs apply for the component, material, and environment combinations described in the preceding discussion.

3.3.2.3.1 Auxiliary Systems—Alternate Nitrogen System—Summary of Aging Management Evaluation—Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the alternate nitrogen system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.3.2.3 above.

3.3.2.3.2 Auxiliary Systems—Chemistry Sampling System—Summary of Aging Management Evaluation—Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the chemistry sampling system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.3.2.3 above.

3.3.2.3.3 Auxiliary Systems—Circulating Water System—Summary of Aging Management Evaluation—Table 3.3.2-3

The staff reviewed LRA Table 3.3.2-3, which summarizes the results of AMR evaluations for the CWT system component groups.

The applicant stated that it expects no aging effects for stainless steel and polyvinyl chloride (PVC) filters/housings exposed to a plant indoor air environment. The staff's review of plant-specific and industry operating experience found no aging effects expected for stainless steel and PVC filters/housings exposed to a plant indoor air environment in the CWT system.

Likewise, the applicant stated that it expects no aging effects for rubber expansion joints exposed to plant indoor air and treated water environments. RAIs 3.3.2.3-3 and 3.3.2.3-4 in SER Section 3.3.2.3 discuss the staff's evaluation.

Based on the above evaluations, the staff found that the applicant has identified the appropriate AMP for the materials and environment associated with the above components in the CWT system.

3.3.2.3.4 Auxiliary Systems—Control Rod Drive System—Summary of Aging Management Evaluation—Table 3.3.2-4

The staff reviewed LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the CRD system component groups.

The applicant proposed to manage the CRD system aging effects with the System Condition Monitoring Program. SER Section 3.0.3.3.2 documents the staff's review of the applicant's System Condition Monitoring Program.

The staff's review of LRA Table 3.3.2-4 identified an area for which it needed additional information to complete its evaluation of the applicant's results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.3.2.3-1, dated July 20, 2005, the staff noted that LRA Table 3.3.2-4 identifies SCC as an AERM for stainless steel piping and fittings in a primary containment air environment. To manage this aging effect, the applicant credited the System Conditioning Monitoring Program, which uses visual inspections of component external surfaces for detection of aging effects; therefore, the staff requested that the applicant provide operating experience or other bases for determining that SCC is an aging effect in this environment. In addition, since methods like VT-1, liquid penetrant, or volumetric inspections are used to detect SCC, the staff asked the applicant to identify the methods and acceptance criteria of the System Conditioning Monitoring Program to detect SCC for these components.

In its response, by letter dated August 16, 2005, the applicant stated the following:

> Data suggests that temperature is an important factor in stress corrosion cracking (SCC) and that SCC is seldom found at temperatures below 140 degrees F. However, a review of plant operating experience revealed two locations where cracking was observed on the exterior of the Control Rod Drive

System (CRD) withdrawal lines, prompting NMC to manage cracking on the exterior of the stainless steel CRD lines located inside containment.

In 1998, during performance of the visual walkdown portion of the reactor coolant pressure boundary leakage test, a crack was identified on a CRD withdrawal line within the drywell. The specific CRD is CRD 34-27. Failure analysis performed by a metallurgical laboratory revealed the cause to be transgranular stress corrosion cracking (TGSCC) due to chloride attack of the external surface. This evaluation showed the cracking to originate from the outside diameter inwards. Also, the metallurgical laboratory found chloride in the through wall flaw. The source of the chloride contamination was not positively identified. The leaking pipe was in an area located directly under catwalks. These open areas are more vulnerable to contamination due to personnel traffic and potential for spills.

As a result of the leak, the following inspections were made during the 1998 refueling outage:

- All lines were VT-2 inspected during the ASME Code, Section XI, reactor coolant pressure boundary leakage test. No leaks were found after the cracked piping was replaced.

- All elbows (where the vertical run turns horizontal for penetration of the biological shield) were visually inspected. There were no indications.

- Dye penetrant testing on the elbows of 14 withdraw lines in the same bundle as CRD 34-27 (outside of the biological shield, with the exception of an elbow on CRD 38-27 which was inside the biological shield.) was conducted. No indications were found.

During the 2000 outage, the accessible CRD piping had been wiped down and foreign material, including tape, was removed. After the piping was cleaned, an inspection of 504 one-foot long sections of all accessible CRD insert and withdrawal lines from the hydraulic accumulator units (HCUs) to the reactor pedestal was implemented. A crack indication was found on CRD withdrawal line 14-27 inside the drywell. The drywell pipe section contained a defect greater than 10% through wall. The apparent cause of the indication appears to have been chloride induced SCC. The indication was identified as being under a piece of tape on a vertical section of the withdraw line. The laborer removing the tape from the area with the relevant indication noted that that particular piece of tape was different from the others removed in that it was both discolored and difficult to remove. It is possible, although unlikely, that the chlorides necessary for TGSCC leached from this tape. However, a more plausible explanation is that chloride contaminated water from another source dripped down the pipe and the tape acted as a crevice, providing a spot for the aqueous chlorides to begin their attack. A source of aqueous chlorides leaking from above would be consistent with the relevant conditions found during the 1998 refueling outage.

In view of this plant specific operating experience, NMC conservatively assumed cracking on the external surface of the CRD pipes inside the drywell despite the extensive testing already conducted. The cracking will be managed using the System Condition Monitoring Program. The System Condition Monitoring Program is an existing plant-specific program. This program manages aging effects for normally accessible, external surfaces of piping, tanks, and other components and equipment within the scope of license renewal. The aging effects are to be managed through visual inspection to look for degradation conditions such as crack-like indications and corrosion. Crack-like indications will be entered into the corrective action process for evaluation. The evaluation will include appropriate acceptance criteria based on applicable code specifications and industry practices such as EPRI. The evaluation will consider the need for further surface examinations such as liquid penetrant or volumetric inspection to determine the extent of condition.

The staff reviewed the applicant's response and found it acceptable. The applicant satisfactorily explained its management of SCC as an aging effect in this environment and identified the methods and acceptance criteria used by System Conditioning Monitoring Program to detect SCC for these components. The staff's concern described in RAI 3.3.2.3-1 is resolved.

The staff's review of plant-specific and industry operating experience found that the System Condition Monitoring Program effectively manages cracking due to SCC of stainless steel material for component types in the CRD system; therefore, the staff found that the applicant has identified the appropriate AMP for the materials and environment associated with the above CRD system components.

3.3.2.3.5 Auxiliary Systems—Demineralized Water System—Summary of Aging Management Evaluation—Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the DWS component groups.

The applicant stated that it expects no aging effects for PVC and fiberglass piping, fittings, pump casings, tanks, thermowells, and valve bodies exposed to plant indoor air and treated water environments in the DWS. On the basis of its review of plant-specific and industry operating experience, the staff agreed with this statement.

RAIs 3.3.2.3-4 and 3.3.2.3-5 in SER Section 3.3.2.3 discusses the staff's evaluation with respect to the lack of aging effects for rubber piping and fittings exposed to a plant indoor air and treated water environments.

Based on the above evaluations, the staff found that the applicant has identified the appropriate AMP for the materials and environment associated with the above components in the DWS.

In LRA Table 3.3.2-5, the applicant proposed to manage loss of material due to pitting and crevice corrosion and MIC of copper alloy materials for the component types of flow elements, piping and fittings, and valve bodies exposed to a treated water environment with the Plant Chemistry Program combined with the One-Time Inspection Program.

The staff reviewed and evaluated the applicant's Plant Chemistry Program and the One-Time Inspection Program, as documented in SER Sections 3.0.3.2.19 and 3.0.3.1.4, respectively. The Plant Chemistry Program mitigates the aging effects on component surfaces exposed to water as the process fluid; chemistry programs control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth, or that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits. The new One-Time Inspection Program is consistent with the recommendations of GALL AMP XI.M32, and includes measures to verify the effectiveness of the Plant Chemistry Program. The One-Time Inspection Program addresses concerns and provides confirmation of the potential long incubation period for certain aging effects on SCs. If system contaminants are maintained within the limits specified by the Plant Chemistry Program, the corrosion exhibited by the copper alloy in a closed system is adequately managed. The applicant has chosen a different combination of AMPs to manage the AERM. The staff found this combination adequate and acceptable for managing this material, environment, and aging effect because contaminants are maintained within limits to inhibit corrosion of the copper alloy.

In LRA Table 3.3.2-5, the applicant proposed to manage loss of material due to selective leaching of copper alloy materials for the component types of flow elements, piping and fittings, and valve bodies exposed to a treated water (internal) environment with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the applicant's Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement of certain susceptible components to determine if selective leaching occurs. The staff determined that this AMP is adequate for managing this material, environment, and aging effect.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the Plant Chemistry Program, combined with the One-Time Inspection and the Selective Leaching OF materials Programs, effectively manages the aging effect of loss of material due to MIC and selective leaching of copper alloy material exposed internally to treated water environment given in LRA Table 3.3.2-5.

3.3.2.3.6 Auxiliary Systems—Emergency Diesel Generators System—Summary of Aging Management Evaluation—Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the DGN component groups.

The staff reviewed AMR line items for the DGN, which experiences cracking due to SCC of copper alloy, carbon steel, and cast iron; fouling of copper alloy; and loss of material for copper alloy for the following component types:

- piping and fittings
- fasteners and bolting
- flame arrestors
- gauges (flow, sight and level)

- heat exchangers
- pump casings
- tanks
- valve bodies
- heaters/coolers

For those components requiring staff review, the following environments apply:

- exposed to weather (external)
- treated water (internal)
- lubricating oil (external)
- fuel oil (internal)
- treated water (external)

RAI 3.3.2.3-7 in SER Section 3.3.2.3 discusses the staff's evaluation with respect to aging effects for stainless steel fasteners and bolting exposed to weather environment as well as for copper alloy flame arrestors exposed to weather environment is discussed in RAI 3.3.2.3-7 in SER Section 3.3.2.3. RAIs 3.3.2.3-4 and 3.3.2.3-6 in SER Section 3.3.2.3 discuss the staff's evaluation with respect to aging effects for rubber piping and fittings exposed to a plant indoor air and gas instrument air environments. RAI 3.3.2.3-2 in SER Section 3.3.2.3 discusses the staff's review of the management of fouling of heat exchangers in a lubricating oil environments using the One-Time Inspection Program.

The applicant proposed to manage DGN aging effects with the CCCW System Program, One-Time Inspection Program, and Fuel Oil Chemistry Program. SER Sections 3.0.3.2.12, 3.0.3.1.4, and 3.0.3.2.17, respectively, document the staff's evaluation of these programs.

The staff's review of plant-specific and industry operating experience found that the Closed-Cycle Cooling Water System Program, One-Time Inspection Program, Fuel Oil Chemistry Program effectively manage cracking due to SCC of copper alloy, carbon steel, and cast iron, fouling of copper alloy, and loss of material for copper alloy for DGN component types.

Based on the above evaluations, the staff found that applicant has identified the appropriate AMPs for the materials and environment associated with the above components of the DGN components.

In LRA Table 3.3.2-6, the applicant proposed to manage heat transfer degradation due to fouling of copper alloy materials for component types of heat exchangers exposed to a treated water environment with the Closed-Cycle Cooling Water System Program.

In LRA Table 3.3.2-6, the applicant proposed to manage loss of material due to pitting and crevice corrosion, and MIC of copper alloy materials for component types including gauges (flow, level, and sight), heat exchangers, and valve bodies exposed to a treated water environment with the Closed-Cycle Cooling Water System Program.

SER Section 3.0.3.2.12 documents the staff's review and evaluation of the applicant's CCCW Program. The CCCW Program includes (1) preventive measures to minimize corrosion and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm performance of intended functions. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters like pH, in accordance with the guidelines of EPRI TR-1007820, vendor recommendations, and plant operating experience.

As the applicant made only minor changes to its CCCW System Program to implement EPRI TR-1007820, the program is also still in accordance with the guidelines identified in GALL AMP XI.M21 (i.e., EPRI TR-107396). The applicant also performs periodic inspection and testing to confirm function and monitor corrosion in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant operating experience. If system corrosion inhibitor concentrations are maintained within the limits specified by the Plant Chemistry Program, corrosion of the copper alloy in a closed system is adequately managed. The staff found this AMP adequate for managing this material, environment, and aging effect.

In LRA Table 3.3.2-6, the applicant proposed to manage loss of material due to selective leaching of copper alloy materials for the component types of gauges (flow, level, and sight), heat exchangers, and valve bodies exposed to treated water environment with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the applicant's Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement of certain components susceptible to selective leaching. The program will determine if selective leaching occurs for certain components. The staff found this AMP adequate for managing this material, environment, and aging effect.

In LRA Table 3.3.2-6, the applicant proposed to manage loss of material due to pitting and crevice corrosion and MIC of copper alloy materials for the component types of valve bodies exposed to a fuel oil environment with the Fuel Oil Chemistry Program, combined with the One-Time Inspection Program.

In LRA Table 3.3.2-6, the applicant proposed to manage loss of material due to pitting and crevice corrosion and MIC of stainless steel materials for component types of manifolds, piping and fittings, and valve bodies exposed to a fuel oil environment with the Fuel Oil Chemistry Program, combined with the One-Time Inspection Program.

The staff reviewed and evaluated the applicant's Fuel Oil Chemistry Program, as documented in Section 3.0.3.2.17, and the One-Time Inspection Program, as documented in SER Section 3.0.3.1.4. The Fuel Oil Chemistry Program is an existing program using existing diesel fuel oil system procedures that encompass the GALL Report program recommendations in mitigating and managing aging effects on the internal surfaces of diesel fuel oil storage tanks and associated components in systems that contain diesel fuel oil. The program includes (1) surveillance and monitoring procedures for maintaining diesel fuel oil quality by controlling contaminants in accordance with applicable ASTM standards, (2) periodic draining of water, if present, from diesel fuel oil tanks, (3) periodic or conditional visual inspection of internal surfaces or wall thickness measurements (e.g., by UT) from external surfaces of diesel fuel oil tanks, and (4) one-time inspections of a representative sample of components in systems that contain diesel fuel oil.

The applicant's new One-Time Inspection Program is consistent with the recommendations of GALL AMP XI.M32. This program will include measures to verify the effectiveness of the Plant

Chemistry Program and the Fuel Oil Chemistry Program and also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within the scope of license renewal. The One-Time Inspection Program addresses concerns and provides confirmation of the potential long incubation period for certain aging effects on SCs. The staff review found the Fuel Oil Chemistry Program supplemented by the One-Time Inspection Program adequate for managing these material, environment, and aging effects combinations.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the Closed-Cycle Cooling Water System Program, Selective Leaching of Materials Program, or Fuel Oil Chemistry Program combined with the One-Time Inspection Program effectively manage the aging effects of heat transfer degradation due to fouling, loss of material due to pitting and crevice corrosion, and MIC, and loss of material due to selective leaching of copper alloy or stainless steel materials exposed to a treated water (internal or external) or fuel oil environments in LRA Table 3.3.2-6.

3.3.2.3.7 Auxiliary Systems—Emergency Filtration Train System—Summary of Aging Management Evaluation—Table 3.3.2-7

The staff reviewed LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the emergency filtration train system component groups.

RAIs 3.3.2.3-4 and 3.3.2.3-6 discuss the staff evaluation with respect to aging effects for elastomer ventilation seals exposed to air, gas, and plant indoor air environments.

Based on the above evaluation, the staff found that the applicant has identified the appropriate AMPs for the materials and environments associated with the above components in the emergency filtration train system.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material due to selective leaching of copper alloy materials for the component types of chillers exposed to a wet air/gas (external) environment with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement of certain components susceptible to selective leaching to determine if selective leaching occurs.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the Selective Leaching of Materials Program effectively manages the aging effect of loss of material due to selective leaching of copper alloy material exposed externally to a wet air/gas environment. On this basis, the staff found the applicant's program to manage loss of material due to selective leaching in LRA Table 3.3.2-7 acceptable.

3.3.2.3.8 Auxiliary Systems—Emergency Service Water System—Summary of Aging Management Evaluation—Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the ESW system component groups.

The staff reviewed AMR line items for the ESW system. This system experiences fouling of the copper alloy component of heat exchangers.

For those components requiring staff review, the lubricating oil (external) environment applies.

The applicant proposed to manage the ESW system aging effects with the One-Time Inspection Program. SER Section 3.0.3.1.4 documents the staff's evaluation of this program.

RAI 3.3.2.3-2 discusses the staff evaluation with respect to managing fouling of heat exchangers in a lubricating oil environment using the One-Time Inspection Program.

The staff's review of the plant-specific and industry operating experience found that the One-Time Inspection Program effectively manages fouling of copper alloy components in the ESW system.

Based on the above evaluation, the staff found that the applicant has identified the appropriate AMP for the material and environment associated with the above components in the ESW system.

3.3.2.3.9 Auxiliary Systems—Fire System—Summary of Aging Management Evaluation—Table 3.3.2-9

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the FIR component groups.

In LRA Section 3.3.2.1.9 and Table 3.3.2-9, the applicant identified the materials, environments, and AERMs. The materials identified include bronze, carbon steel, cast iron, copper alloy, ductile iron, galvanized steel, gray cast iron, and stainless steel.

The applicant identified the inside, outside, and buried environments to which these materials could be exposed as air and gas (wetted, ambient and dry), atmosphere/weather, halon, raw water, and treated water. The applicant identified loss of material (from corrosion or leaching) and heat transfer degradation due to fouling as the aging effects associated with the FIR.

The applicant proposed to manage the FIR aging effects with the Bolting Integrity Program, Buried Piping & Tanks Inspection Program, Fire Protection Program, Fire Water System Program, and System Condition Monitoring Program. SER Sections 3.0.3.2.4, 3.0.3.2.5, 3.0.3.2.15, 3.0.3.2.16, and 3.0.3.3.2, respectively, document the staff's evaluations of these programs.

The staff reviewed LRA Section 3.3.2.1.9 and LRA Table 3.3.2-9 to determine whether the applicant demonstrated that it will adequately manage the aging effects for the FIR during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff conducted its review, described below, in accordance with SRP-LR Section 3.3 and the GALL Report.

The staff's review of LRA Table 3.3.2-9 identified areas for which it needed additional information to complete its evaluation of the applicant's results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.3.2.1.9-1, dated August 18, 2005, the staff noted that LRA Table 3.3.2-9 refers to Notes J and 319, which describe the AMRs for copper alloy in heat exchangers; therefore, the staff requested that the applicant justify the conclusion in Note 319 that "the AMP referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation."

In its response, by letter dated September 16, 2005, the applicant stated that the Fire Water System Program manages aging of water-based FIR piping and components in accordance with applicable NFPA recommendations. The FP AMP manages aging of fire barriers, the diesel-driven fire pump, and the halon fire suppression system consistent with the GALL Report, since GALL AMP XI.M26 states for FP that, "For operating plants, the fire protection AMP includes a fire barrier inspection program and a diesel-driven fire pump inspection program." As a result, both the Fire Water System and Fire Protection Programs are credited for line items such as filter/strainers, manifolds, pump casings, and valve bodies because these line items apply to both the diesel-driven fire pump (Fire Protection Program) as well as the remainder of the water-based components (Fire Water System Program). In this specific case, the Fire Protection Program, not the Fire Water System Program, manages the copper alloy heat exchanger (radiator) for the diesel-driven fire pump addressed in the Fire Protection Program. Consequently, Note J, which states, "Neither the component nor the material and environment combination is evaluated in NUREG-1801," applies to this line item because the GALL Report, Section VII.G, addresses the diesel-driven fire pump copper heat exchanger in neither a treated water nor raw water environment. Additionally, Note 319, which states the following, further defines this issue:

> NUREG-1801, Volume 2, Chapter VII (Auxiliary Systems), Section G.6 (Fire Protection) does not address this environment for the mechanical portion of the Fire Protection AMP (XI.M26). The AMP referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation to further define this issue.

Consequently, the Fire Protection Program, as defined in LRA Section B2.1.17, is appropriate to manage the aging effects of heat transfer degradation and loss of material for the copper alloy diesel-driven fire pump heat exchanger addressed in LRA Table 3.3.2-9 and assures effective management of the aging effects/mechanisms through the period of extended operation.

Based on its review, the staff found the applicant's response to RAI 3.3.2.1.9-1 acceptable because it adequately explains that the GALL Report does not evaluate the copper alloy diesel-driven fire pump heat exchanger, in both treated water and raw water environments. The applicant stated that the Fire Protection Program manages the aging effects of heat transfer degradation and loss of material for the copper alloy diesel-driven fire pump heat exchanger.

The staff reviewed the applicant's Fire Protection Program and found acceptable the management of heat transfer degradation due to fouling and loss of material due to general, galvanic, crevice, and pitting corrosion and MIC, as given in LRA Table 3.3.2-9; therefore, the staff's concern described in RAI 3.3.2.1.9-1 is resolved.

In RAI 3.3.2.1.9-2, dated August 18, 2005, the staff noted that LRA Table 3.3.2-9 shows no AMP for stainless steel fasteners/bolting; therefore, the staff requested that the applicant explain why these fasteners/bolting do not require an AMP as recommended by GALL AMP XI.M18.

In its response, by letter dated September 16, 2005, the applicant stated that Table 3.3.2-9 identifies stainless steel fasteners/bolting in exposed to weather and plant indoor air external environments. The applicant's materials science position, which is consistent with EPRI 1003056, is that these components have no surface exposed to an aggressive chemical species, have no potential for concentrating contaminants, and are not subject to wetting other than their normal environment; therefore, loss of material is not a potential aging effect as identified by LRA Note 327. Additionally, the FIR has no bolts with a specified minimum yield strength >150 ksi.

Crevice corrosion is a potential aging mechanism for wetted stainless steel under certain conditions. Crevice corrosion depends strongly on the presence of dissolved oxygen. Although oxygen depletion in crevices may occur as a result of corrosion, oxygen is still required for the onset of corrosion and bulk fluid oxygen content or the presence of contaminants like chlorides is necessary for the continued dissolution of material in the crevice. In systems with extremely low oxygen content (< 0.1 ppm), crevice corrosion is considered insignificant. This form of corrosion requires a crevice where contaminants and corrosion products can concentrate. In addition to oxygen, moisture is required for the mechanism to operate. Alternate wetting and drying is particularly harmful as this leads to a concentration of atmospheric pollutants and contaminants, if present. These conditions do not exist for stainless steel fasteners/bolting at MNGP.

Pitting corrosion is a potential aging mechanism for wetted stainless steel under certain conditions. Unless cupric, ferric, or mercuric halides are present in the environment, oxygen is required for pitting initiation. Areas where aggressive species can concentrate are particularly susceptible to pitting. Most pitting is the result of halide contamination with prevalent chlorides, bromides, and hypochlorites. Pitting is a significant aging effect for stainless steels when exposed to a corrosive environment. Any continuously wetted or alternately wetted and dried surfaces tend to concentrate any aggressive species, if they are present, and are prone to pitting corrosion. These conditions also do not exist for stainless steel fasteners/bolting at MNGP.

For conservatism during the integrated plant assessment process, both the exposed to weather and plant indoor air environments include the stainless steel fastener/bolting component to ensure that the evaluations have not inadvertently omitted any components, materials, or environments from the evaluations; however, recent walkdowns of the FIR revealed no stainless steel fasteners/bolting exposed to weather.

Consequently, the applicant will remove the FIR stainless steel fasteners/bolting exposed to weather asset from LRA Table 3.3.2-9. Stainless steel fasteners/bolting in a plant indoor air environment have no aging effects for the same reasons as stated above.

Based on its review, the staff found the applicant's response to RAI 3.3.2.1.9-2 acceptable, because the applicant stated that stainless steel fasteners/bolting in the FIR have no potential for concentrating contaminants and are not subject to wetting other than their normal environment. The applicant also stated that recent walkdowns of the FIR revealed no stainless steel fasteners/bolting exposed to weather, so it will remove this asset from LRA Table 3.3.2-9; therefore, the staff's concern described in RAI 3.3.2.1.9-2 is resolved.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the aging effects from exposure of the fire water system components to the environments described in LRA Table 3.3.2.6 are consistent with the GALL Report and with industry experience for these material-environment combinations; therefore, the staff found that the applicant identified the applicable aging effects and associated AMPs and that they are appropriate for the combination of materials and environments listed.

In LRA Table 3.3.2-9, the applicant proposed to manage heat transfer degradation due to fouling, loss of material due to crevice and pitting corrosion, MIC, and loss of material due to selective leaching of copper alloy materials for the component types of heat exchangers exposed to a raw water environment with the Fire Protection Program.

In LRA Table 3.3.2-9, the applicant proposed to manage loss of material due to crevice and pitting corrosion, MIC, and loss of material due to selective leaching of copper alloy materials for the component types of heat exchangers exposed to a glycol corrosion-inhibited treated water (external) environment with the Fire Protection Program.

In LRA Table 3.3.2-9, the applicant proposed to manage loss of material due to general, galvanic, crevice, and pitting corrosion, MIC, and loss of material due to selective leaching of gray cast iron materials for the component types of heat exchangers exposed to a glycol corrosion-inhibited treated water (internal) environment with the Fire Protection Program.

The staff reviewed and evaluated the Fire Protection Program, as documented in SER Section 3.0.3.2.15. The Fire Protection Program includes a fire barrier inspection program, a diesel-driven fire pump inspection program, and a halon fire suppression system inspection. The program requires periodic visual inspection of fire barriers, seals, walls, ceilings, floors, and associated fire-rated doors. The diesel-driven fire pump inspection program periodically tests the pump and inspects the diesel engine to ensure that the fuel supply line can perform the intended function. The halon fire-suppression system inspection includes periodic inspection and testing of the cable spreading room halon fire-suppression system. The applicant will enhance the existing Fire Protection Program under the Parameters Monitored or Inspected element to be consistent, with certain exceptions, with GALL AMP XI.M26, as modified by ISG-04. The exception to the GALL Report concerns the periodic visual inspection and function test of halon systems at least once every 6 months. The applicant functionally tests and visually inspects the cable spreading room halon system every 18 months instead of every 6 months as recommended in the GALL Report. The staff found this exception acceptable, as documented in SER Section 3.0.3.2.15.

With respect to copper alloy in raw water, the staff has accepted that these AERMs exist in other systems, such as CWT and diesel generator support systems. The fire water and FP systems also have instances of copper alloy in raw water. The applicant credits the Fire Protection Program with managing loss of material due to crevice and pitting corrosion, MIC, and selective leaching. The staff review found this AMP adequate for managing this material, environment, and aging effect. With respect to copper alloy in glycol corrosion-inhibited treated water (external), the staff has accepted that these AERMs exist in other systems, such as the CWT and diesel generator support systems. With respect to gray cast iron in glycol corrosion-inhibited treated water (external), the applicant credited the Fire Protection Program with managing loss of material due to general, galvanic, crevice, and pitting corrosion, MIC, and selective leaching. The staff's review found this AMP adequate for managing the AERMs of heat transfer degradation due to fouling, loss of material due to crevice and pitting corrosion, and MIC for the materials identified.

In RAI 3.3.2.2.5-1, dated October 31, 2005, the staff requested that the applicant demonstrate how the Fire Water System and the Fire Protection Programs will manage loss of material due to selective leaching for these materials.

In its response, dated November 22, 2005, the applicant stated that it inadvertently omitted the FIR from the applicable systems table in LRA Section B2.1.30 (under "Scope of Program") for the Selective Leaching of Materials Program. The applicant agreed to revise LRA Section B2.1.30 to include the FIR within the scope of the program. In its letter dated February 28, 2006, the applicant revised LRA Section B2.1.30 to include the FIR within the scope of the program.

Additionally, in its response, the applicant stated that under "Scope of Program," the Fire Protection, Fire Water System, and Buried Piping & Tanks Programs credit the Selective Leaching of Materials Program for managing loss of material due to selective leaching. The applicant inadvertently omitted such credits not specifically stated from these program descriptions in the LRA for the respective AMPs.

It was not clear to the staff how the applicant intended to credit the Selective Leaching of Material Program, as the Parameters Monitored or Inspected element and the Detection of Aging Effects element for the AMPs do not specify any components that could have an aging effect of loss of material due to selective leaching. The applicant agreed to revise these AMPs to describe how they will credit the Selective Leaching of Materials Program. In its letter, dated February 28, 2006, the applicant revised the Scope of Program element for the Fire Protection, Fire Water System, and Buried Piping & Tanks Programs to include loss of material due to selective leaching by crediting the Selective Leaching of Materials Program.

The staff found this response acceptable; therefore, the staff's concern described in RAI 3.3.2.2.5-1 is resolved.

In LRA Table 3.3.2-9, the applicant proposed to manage loss of material due to galvanic and general corrosion of carbon steel materials for the component types of valve bodies exposed to air/gas (internal) environment with the Fire Water System Program.

The staff reviewed and evaluated the Fire Water System Program, as documented in SER Section 3.0.3.2.16. The Fire Water System Program relies on testing of water-based FP system piping and components in accordance with applicable NFPA recommendations. In addition, the applicant will modify this program to include (1) portions of the FP sprinkler system subject to full-flow tests before the period of extended operation and (2) portions of the FP system exposed to water that are visually inspected internally. Periodic full-flow flush tests and system performance tests ensure that the aging mechanisms of corrosion and biofouling/fouling are properly managed in the fire water system. With respect to carbon steel in an air/gas (internal) environment, the applicant has chosen, for conservatism, to manage the AERM as though the environment were water. The staff review found this AMP adequate for managing this material, environment, and aging effect.

On the basis of its review of the applicant's programs, aging effects and plant-specific and industry operating experience, the staff determined that the Fire Protection and Fire Water System Programs effectively manage the aging effect of heat transfer degradation due to fouling, loss of material due to general, galvanic, crevice, and pitting corrosion and MIC, and loss of material due to selective leaching of copper alloy, gray cast iron, and carbon steel materials exposed to raw water, glycol corrosion-inhibited treated water (internal and external), and air/gas (internal) environments. On this basis, the staff found acceptable the management of heat transfer degradation due to fouling, loss of material due to general, galvanic, crevice, and pitting corrosion and MIC, and loss of material due to selective leaching in LRA Table 3.3.2-9.

3.3.2.3.10 Auxiliary Systems—Fuel Pool Cooling and Cleanup—Summary of Aging Management Evaluation—Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the FPC component groups.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material due to crevice and pitting corrosion and MIC of copper alloy materials for the component types of piping and fittings, and valve bodies exposed internally to a treated water environment with the Plant Chemistry Program combined with the One-Time Inspection Program.

The staff reviewed and evaluated the applicant's Plant Chemistry Program and the One-Time Inspection Program, as documented in SER Sections 3.0.3.2.19 and 3.0.3.1.4, respectively. The Plant Chemistry Program mitigates the aging effects on component surfaces that are exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits. The new One-Time Inspection Program is consistent with the recommendations of GALL AMP XI.M32 and will verify the effectiveness of the Plant Chemistry Program. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs. The staff review determined that the Plant Chemistry Program supplemented by the One-Time Inspection Program is adequate for managing this material, environment, and aging effect combination.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material due to selective leaching of copper alloy materials for the component types of piping and fittings, and valve bodies exposed internally to a treated water environment with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement to determine if selective leaching occurs for certain susceptible components. The staff's program review found management of loss of material due to selective leaching in LRA Table 3.3.2-7 acceptable.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the Plant Chemistry Program combined with the One-Time Inspection Program, and the Selective Leaching of Materials Program, effectively manage the aging effects of loss of material due to crevice and pitting corrosion, MIC, and selective leaching of copper alloy material exposed to a treated water (internal) environment. On this basis, the staff found management of loss of material due to crevice and pitting corrosion, MIC, and selective leaching, as given in LRA Table 3.3.2-10, acceptable.

3.3.2.3.11 Auxiliary Systems—Heating and Ventilation—Summary of Aging Management Evaluation—Table 3.3.2-11

The staff reviewed LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the HTV component groups.

In LRA Table 3.3.2-11, the applicant proposed to manage loss of material due to pitting and crevice corrosion of copper alloy materials for the component types of heaters/coolers, heating, ventilation, and air conditioning (HVAC) units, piping and fittings, and valve bodies exposed to a treated water or steam environment with the Closed-Cycle Cooling Water System Program.

The staff reviewed and evaluated the CCCW System Program, as documented in SER Section 3.0.3.2.12. The CCCW System Program includes (1) preventive measures to minimize corrosion and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm performance of intended functions. Preventive measures monitor and control corrosion inhibitors and other chemical parameters like pH, in accordance with the guidelines of EPRI TR-1007820, vendor recommendations, and plant operating experience. As only minor changes were made to the CCCW System Program to implement EPRI TR-1007820, the program is also still consistent with the guidelines identified in GALL AMP XI.M21 (i.e., EPRI TR-107396). Periodic inspection and testing to confirm function and monitor corrosion are also performed in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant-operating experience. The staff's review found this AMP adequate for managing this material, environment, and aging effect.

In LRA Table 3.3.2-11, the applicant proposed to manage loss of material due to pitting and crevice corrosion and MIC of copper alloy materials for the component types of gauges (flow, level, and sight), chillers, piping and fittings, and valve bodies exposed to a treated water environment with the One-Time Inspection Program.

The staff reviewed and evaluated the One-Time Inspection Program, as documented in SER Section 3.0.3.1.4. The new One-Time Inspection Program is consistent with the recommendations of GALL AMP XI.M32 and verifies the effectiveness of the Plant Chemistry

Program and the Fuel Oil Chemistry Program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within the scope of license renewal. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs. The applicant noted in the LRA that in some cases in which aging effects/mechanisms are not expected to be significant, the one-time inspection alone is credited with managing them. The staff's review determined that the use of the One-Time Inspection Program alone is acceptable in certain cases, such as no-flow conditions, where the CCCW System Program is not a viable option. The staff's review determined that this AMP is appropriate for the aging effects/mechanisms identified and assures effective management of them through the period of extended operation.

In LRA Table 3.3.2-11, the applicant proposed to manage loss of material due to selective leaching of copper alloy materials for the component types of chillers, gauges (flow, level, and sight), heaters/coolers, HVAC units, piping and fittings, and valve bodies exposed to treated water, treated water or steam (internal), and wet air/gas (external) environments with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement to determine if selective leaching occurs for certain susceptible components. The staff's review found this AMP adequate for managing this material, environment, and aging effect.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the Closed-Cycle Cooling Water System Program, One-Time Inspection Program, and Selective Leaching of Materials Program effectively manage the aging effect of loss of material due to pitting and crevice corrosion, MIC, and selective leaching of copper alloy material exposed to treated water (internal), treated water or steam (internal), and wet air/gas (external) environments. On this basis, the staff found that management of loss of material due to pitting and crevice corrosion, MIC, and selective leaching in LRA Table 3.3.2-11 is acceptable.

3.3.2.3.12 Auxiliary Systems—Instrument and Service Air System—Summary of Aging Management Evaluation—Table 3.3.2-12

The staff reviewed LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the AIR system component groups.

In LRA Table 3.3.2-12, the applicant proposed to manage loss of material due to crevice and pitting corrosion and MIC of copper alloy materials for the component types of gauges (flow, level, and sight) and valve bodies exposed to a treated water environment with the CCCW System Program.

The staff reviewed and evaluated the CCCW System Program, as documented in SER Section 3.0.3.2.12. The CCCW System Program includes (1) preventive measures to minimize corrosion and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm performance of intended functions. Preventive measures monitor and control corrosion inhibitors and other chemical parameters like pH in accordance with the guidelines of EPRI TR-1007820, vendor recommendations, and plant operating experience. As only minor changes were made to the CCCW System Program to implement EPRI TR-1007820, the program is also still consistent with the guidelines identified in GALL AMP XI.M21 (i.e., EPRI TR-107396). Periodic inspection and testing to confirm function and monitor corrosion are also performed in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant operating experience. The staff's review found this AMP adequate for managing this material, environment, and aging effect.

In LRA Table 3.3.2-12, the applicant proposed to manage loss of material due to crevice and pitting corrosion and MIC of copper alloy materials for the component types of valve bodies exposed to a gas-compressed air environment with the Compressed Air Monitoring Program.

The staff reviewed and evaluated the Compressed Air Monitoring Program, as documented in SER Section 3.0.3.2.13. The Compressed Air Monitoring Program consists of inspection, monitoring, and testing of the AIR system for reasonable assurance that the components will perform their intended functions for the period of extended operation. With respect to copper alloy in a gas-compressed air environment, MNGP has chosen, for conservatism, to manage the AERM as though it were an environment with condensation. The staff's review found this AMP adequate for managing this material, environment, and aging effect.

In LRA Table 3.3.2-12, the applicant proposed to manage loss of material due to selective leaching of copper alloy materials for the component types of gauges (flow, level, and sight) and valve bodies exposed to treated water and gas-compressed air environments with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement to determine if selective leaching occurs for certain susceptible components. The staff's review found this AMP adequate for managing this material, environment, and aging effect.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the Closed-Cycle Cooling Water System Program, Compressed Air Monitoring Program, and Selective Leaching of Materials Program effectively manage the aging effect of loss of material due to crevice and pitting corrosion, MIC, and selective leaching of copper alloy material exposed to treated water (internal) and gas-compressed air (internal) environments. On this basis, the staff found management of loss of material due to crevice and pitting corrosion, MIC, and selective leaching in LRA Table 3.3.2-12 acceptable.

3.3.2.3.13 Auxiliary Systems—Radwaste Solid and Liquid System—Summary of Aging Management Evaluation—Table 3.3.2-13

The staff reviewed LRA Table 3.3.2-13, which summarizes the results of AMR evaluations for the radwaste solid and liquid system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.3.2.3 above.

3.3.2.3.14 Auxiliary Systems—Reactor Building Closed Cooling Water System—Summary of Aging Management Evaluation—Table 3.3.2-14

The staff reviewed LRA Table 3.3.2-14, which summarizes the results of AMR evaluations for the RBC system component groups.

In LRA Table 3.3.2-14, the applicant proposed to manage loss of material due to crevice and pitting corrosion and MIC of copper alloy materials for component types of piping and fittings and valve bodies exposed to a treated water environment with the CCCW System Program.

The staff reviewed and evaluated the CCCW System Program, as documented in SER Section 3.0.3.2.12. *The CCCW System Program includes (1) preventive measures to minimize* corrosion and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm performance of intended functions. Preventive measures monitor and control corrosion inhibitors and other chemical parameters like pH, in accordance with the guidelines of EPRI TR-1007820, vendor recommendations, and plant operating experience. As only minor changes were made to the CCCW System Program to implement EPRI TR-1007820, the program is also still consistent with the guidelines identified in GALL AMP XI.M21 (i.e., EPRI TR-107396). Periodic inspection and testing to confirm function and monitor corrosion are also performed in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant operating experience. The staff's review found this AMP adequate for managing this material, environment, and aging effect.

In LRA Table 3.3.2-14, the applicant proposed to manage loss of material due to selective leaching of copper alloy materials for the component types of piping and fittings and valve bodies exposed to a treated water environment with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement to determine if selective leaching occurs for certain susceptible components. The staff's review found this AMP adequate for managing this material, environment, and aging effect.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the Closed-Cycle Cooling Water System Program and Selective Leaching of Materials Program effectively manage the aging effect of loss of material due to crevice and pitting corrosion, MIC, and selective leaching of copper alloy material exposed to a treated water (internal) environment. On this basis, the staff found that management of loss of material due to crevice and pitting corrosion, MIC, and selective leaching, as given in LRA Table 3.3.2-14, is acceptable.

3.3.2.3.15 Auxiliary Systems—Reactor Water Cleanup System—Summary of Aging Management Evaluation—Table 3.3.2-15

The staff reviewed LRA Table 3.3.2-15, which summarizes the results of AMR evaluations for the RWCU system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.3.2.3 above.

3.3.2.3.16 Auxiliary Systems—Service and Seal Water System—Summary of Aging Management Evaluation—Table 3.3.2-16

The staff reviewed LRA Table 3.3.2-16, which summarizes the results of AMR evaluations for the service and seal water system component groups.

RAIs 3.3.2.3-3 and 3.3.2.3-4 discuss the staff evaluation with respect to aging effects for rubber expansion joints exposed to plant indoor air and raw water environments in the service and seal water system.

Based on the RAI evaluations, the staff found that the applicant has identified the appropriate AMP for the materials and environments associated with the above components in the service and seal water system. All other line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.3.2.3 above.

3.3.2.3.17 Auxiliary Systems—Standby Liquid Control System—Summary of Aging Management Evaluation—Table 3.3.2-17

The staff reviewed LRA Table 3.3.2-17, which summarizes the results of AMR evaluations for the SLC system component groups.

RAI 3.3.2.3-5 discusses the staff evaluation with respect to aging effects for rubber accumulators exposed to nitrogen gas and plant indoor air environments in the SLC system.

Based on the evaluation of the response to the above RAI, the staff found that applicant has identified the appropriate AMP for the materials and environments associated with the above components in the SLC system. All other line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.3.2.3 above.

3.3.2.3.18 Auxiliary Systems—Wells and Domestic Water System—Summary of Aging Management Evaluation—Table 3.3.2-18

The staff reviewed LRA Table 3.3.2-18, which summarizes the results of AMR evaluations for the wells and domestic water system component groups.

In LRA Table 3.3.2-18, the applicant proposed to manage loss of material due to crevice and pitting corrosion, MIC, and erosion of copper alloy materials for the component types of piping and fittings and valve bodies exposed to a raw water environment with the One-Time Inspection Program.

The staff reviewed and evaluated the One-Time Inspection Program, as documented in SER Section 3.0.3.1.4. The new One-Time Inspection Program is consistent with the recommendations of GALL AMP XI.M32 and will confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within the scope of license renewal. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs. The applicant has noted in the LRA that in some cases in which aging effects/mechanisms are not expected to be significant, the One-Time Inspection Program alone is credited with managing aging effects. The staff determined that the use of the One-Time Inspection Program alone is acceptable where the use of the Plant Chemistry Program is not a viable option. This AMP is appropriate for the aging effects/mechanisms identified and assures effective management of them through the period of extended operation.

In LRA Table 3.3.2-18, the applicant proposed to manage loss of material due to crevice corrosion, pitting corrosion, and MIC of Hastelloy (C-276) material for the component types of piping and fittings exposed to a raw water environment using the One-Time Inspection Program. In addition, the applicant stated that Hastelloy (C-276) in a concrete or plant indoor air environment has no AERM and therefore requires no AMP.

The staff determined that Hastelloy (C-276) is a highly corrosion-resistant material, and degradation is not expected in typical domestic water applications. Hastelloy (C-276) piping and fitting material exposed to concrete or an air environment in the absence of moisture with contaminants has no aging effects and requires no aging management. Similarly, degradation of Hastelloy (C-267) in a raw water internal environment is not expected. It is conservative to assume loss of material due to crevice and pitting corrosion and MIC in this environment with the potential for unknown contaminants. The staff's review found the One-Time Inspection Program adequate to manage the aging effects of this corrosion-resistant material in this environment to confirm that degradation is not occurring.

In LRA Table 3.3.2-18, the applicant proposed to manage loss of material due to selective leaching of copper alloy materials for the component types of piping and fittings and valve bodies exposed to a raw water environment with the Selective Leaching of Materials Program.

The staff reviewed and evaluated the Selective Leaching of Materials Program, as documented in SER Section 3.0.3.2.22. This new program includes a one-time visual inspection and hardness measurement to determine if selective leaching occurs for certain susceptible components. The staff's review found this AMP adequate for managing this material, environment, and aging effect.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the One-Time Inspection Program and Selective Leaching of Materials Program effectively manage the aging effect of loss of material due to crevice and pitting corrosion, MIC, erosion, and selective leaching of copper alloy material exposed to a raw water (internal) environment. On this basis, the staff found management of loss of material due to crevice and pitting corrosion, MIC, erosion, and selective leaching, as given in LRA Table 3.3.2-18, acceptable.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, AERM, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the aging effects will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the aging effects for the auxiliary systems components that are within the scope of license renewal and subject to an AMR will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concluded that they adequately describe the AMPs credited with managing aging of the auxiliary systems, as required by 10 CFR 54.21(d).

3.4 Aging Management of Steam and Power Conversion System

This section of the SER documents the staff's review of the applicant's AMR results for the SPC system components and component groups associated with the following systems:

- condensate storage system
- condensate and feedwater system
- main condenser system
- main steam system
- turbine generator system

3.4.1 Summary of Technical Information in the Application

In LRA Section 3.4, the applicant provided AMR results for the SPC system components and component groups. In LRA Table 3.4.1, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the SPC system components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.4.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the SPC system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In addition, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs are consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs. SER Section 3.0.3 documents the staff's evaluations of the AMPs. The MNGP audit and review report details the staff's audit evaluation, which are summarized in SER Section 3.4.2.1.

The staff also performed an onsite audit of those selected AMRs that are consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the acceptance criteria in SRP-LR Section 3.4.2.2. The MNGP audit and review report documents the staff's audit evaluations, which are summarized in SER Section 3.4.2.2.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that are not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether the applicant identified all plausible aging effects and whether the aging effects listed are appropriate for the combination of materials and environments specified. The MNGP audit and review report documents the staff's audit evaluations. SER Section 3.4.2.3 summarizes these audit evaluations and documents the staff's evaluation of its technical review.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the SPC system components.

Table 3.4-1 below summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.4 that are addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping and fittings in main feedwater line, steamline and AFW piping (PWR only) (Item Number 3.4.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components (see Section 3.4.2.2.1)
Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head and shell (except main steam system) (Item Number 3.4.1-02)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water chemistry, one-time inspection	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends further evaluation (see Section 3.4.2.2.2)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Auxiliary feedwater (AFW) piping (Item Number 3.4.1-03)	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Plant specific		Not applicable, PWR only (see Section 3.4.2.2.3)
Oil coolers in AFW system (lubricating oil side possibly contaminated with water) (Item Number 3.4.1-04)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion and MIC	Plant specific		Not applicable, PWR only (see Section 3.4.2.2.3)
External surface of carbon steel components (Item Number 3.4.1-05)	Loss of material due to general corrosion	Plant specific	System Condition Monitoring Program (B2.1.32)	Consistent with GALL Report, which recommends further evaluation (see Section 3.4.2.2.4)
Carbon steel piping and valve bodies (Item Number 3.4.1-06)	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion	Flow-Accelerated Corrosion Program (B2.1.19)	Consistent with GALL Report, which recommends no further evaluation
Carbon steel piping and valve bodies in main steam system (Item Number 3.4.1-07)	Loss of material due to pitting and crevice corrosion	Water chemistry	Plant Chemistry Program (B2.1.25), One-Time Inspection (B2.1.23)	This line item was not used at MNGP. See Item Number 3.4.1-02
Closure bolting in high-pressure or high-temperature systems (Item Number 3.4.1-08)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting Integrity Program (B2.1.4)	Consistent with GALL Report, which recommends no further evaluation
Heat exchangers and coolers/condensers serviced by open-cycle cooling water (Item Number 3.4.1-09)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system		Not applicable (see Section 3.4.2.1.1)
Heat exchangers and coolers/condensers serviced by closed-cycle cooling water (Item Number 3.4.1-10)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-cycle cooling water system		Not applicable. No heat exchangers serviced by closed-cycle cooling water

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
External surface of aboveground condensate storage tank (Item Number 3.4.1-11)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Above ground carbon steel tanks		Not applicable. MNGP condensate storage tanks are not within the scope of license renewal
External surface of buried condensate storage tank and AFW piping (Item Number 3.4.1-12)	Loss of material due to general, pitting, and crevice corrosion and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	Buried Piping & Tanks Inspection Program (B2.1.5)	Emergency diesel generators system oil storage tank external surface is managed by the Buried Piping & Tanks Inspection Program
External surface of carbon steel components (Item Number 3.4.1-13)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable, PWR only

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in SER Section 3.4.2.1, involves the staff's review of the AMR results for components in the SPC system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in SER Section 3.4.2.2, involves the staff's review of the AMR results for components in the SPC system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.4.2.3, involves the staff's review of the AMR results for components in the SPC system that the applicant indicated are not consistent with, or not addressed in, the GALL Report. SER Section 3.0.3 documents the staff's review of AMPs that are credited to manage or monitor aging effects of the SPC system components.

3.4.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.4.2.1, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the SPC system components:

- Bolting Integrity Program (B2.1.4)
- Flow-Accelerated Corrosion Program (B2.1.19)
- One-Time Inspection Program (B2.1.23)
- Open-Cycle Cooling Water System Program (B2.1.24)
- Plant Chemistry Program (B2.1.25)
- Selective Leaching of Materials Program (B2.1.30)
- System Condition Monitoring Program (B2.1.32)

Staff Evaluation. In LRA Tables 3.4.2-1 through 3.4.2-5, the applicant summarized the AMRs for the SPC system components, and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the GALL Report evaluation bounds the plant-specific components contained in these GALL Report component groups.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component applies to the component under review. The staff verified that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but the applicant credited a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP will manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs. The following sections discuss the staff's evaluation.

3.4.2.1.1 Loss of Material Due to General, Pitting, and Crevice Corrosion, MIC, and Biofouling; Buildup of Deposit Due to Biofouling

In LRA Table 3.4.1, Item 3.4.1-09, the applicant addressed the loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling, and buildup of deposit due to biofouling for heat exchangers and coolers/condensers serviced by OCCW. The applicant stated that Item 3.4.1-09 does not apply. The applicant stated that the management of aging effects of certain components of the CDR with the intended function of plateout and holdup of radioactive material is not applicable because the CDR structural integrity is demonstrated continuously during normal plant operation.

During the audit and review, the staff noted that in LRA Table 3.4.2-3 the applicant presented its AMR results for the CDR system. In the table, the applicant claimed consistency with the GALL Report for aging management of the internal and external surfaces of the carbon steel condenser shell. The table cited generic Note E (i.e., the component, material, and environment are consistent with the GALL Report recommendation but the applicant applied a different AMP). However, the applicant claimed that an AMP is not required and referenced plant-specific Note 410. The staff questioned the applicant's use of Note E for these AMR entries as no AMP is credited.

In response, the applicant stated that the structural integrity of the CDR required to perform its post-accident intended function is demonstrated continuously during normal plant operation; therefore, no traditional AMP is required. The post-accident intended function of the CDR is to provide a holdup volume and plateout surface for MSIV leakage. This intended function does not require the CDRs to be leak tight because the post-accident conditions in the CDRs are essentially atmospheric and there will be no challenge to their pressure boundary integrity. Normal plant operation assures adequate CDR pressure boundary integrity and the post-accident intended function to provide pressure boundary and holdup volume and plateout surface.

The staff noted that SRP-LR Section A.1.2.3.4 states that a program based solely on detecting SC failures is not considered an effective AMP. The staff then reviewed the applicant's justification and asked it to clarify why it had described no AMP for these components.

The applicant stated that radioactive iodine is assumed to plate out on the interior surfaces of the CDR for both loss of coolant and control rod drop accidents. Aging management is not required for the CDR components that have only a plateout and holdup of radioactive material intended function. For these components, the aging effects do not require aging management as the condenser surface condition does not affect the deposition of iodine in the CDR. To maintain the intended function, the CDR and the components which make up the CDR complex simply have to remain intact. Condenser structural integrity is demonstrated continuously during normal operation when the condenser is required to maintain vacuum. When the condenser is required to perform its intended function following a DBA, the MSIVs will be closed and condenser vacuum will be lost. The condenser will not be required to perform a pressure boundary function because essentially atmospheric conditions will exist inside the condenser. Since normal performance considerations, such as fouling and in-leakage (e.g., CWT or air leaks), place greater requirements on condenser operation than the post-accident plateout, then, as long as the condenser is intact and operational, the post-accident plateout and holdup of radioactive material will be maintained and no aging management is required.

Additionally, as documented in its August 31, 2005, letter, the applicant revised plant-specific Note 410 to clarify the discussion of the intended function of the CDR:

> No traditional aging management of the main condenser for plateout and holdup is required. The main condenser is required to perform a post-accident intended function of plateout and holdup. This post-accident intended function does not require the main condenser to be leak tight and post-accident conditions in the main condenser would be essentially atmospheric. During normal plant operation, the main condenser continuously verifies its structural integrity by maintaining condenser vacuum that is constantly monitored and provides assurance that it will perform its post-accident intended function of iodine plateout and holdup.

The staff's review of the applicant's response found that the CDR need not be leak-tight, as post-accident conditions in the CDR are essentially atmospheric. During normal plant operations, the applicant continuously monitors condenser vacuum to verify the integrity of the CDR. Degradation of its integrity to a loss of vacuum will require placement of the plant in a mode that will obviate the post-accident intended function; therefore, acceptable performance during normal plant operation is adequate assurance that the CDR can perform the holdup and plateout post-accident function.

On this basis, the staff found that the applicant appropriately addressed the aging effect and mechanism as identified in the GALL Report.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. The staff's review concluded that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report; therefore, the staff concluded that the applicant has demonstrated that the aging effects for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application. In LRA Section 3.4.2.2 the applicant provided further evaluation of aging management as recommended by the GALL Report for the

SPC system components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, and crevice corrosion, microbiologically influenced corrosion, and biofouling
- general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.4.2.2. The staff's audit and review report details the staff's audit. The following sections discuss the staff's evaluation of the aging effects.

3.4.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.4.2.2.1, the applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2.

In LRA Section 3.4.2.2.2 the applicant addressed loss of material due to general, pitting, and crevice corrosion of carbon steel and cast iron piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for MST system components in the SPC system. This section also addresses loss of material due to pitting and crevice corrosion of stainless steel components in the SPC system.

SRP-LR Section 3.4.2.2.2 states the following:

> The management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components and for loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The water chemistry program relies on monitoring and control of water chemistry based on the guidelines in BWRVIP-29 (EPRI guideline TR-103515) for water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further

evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In LRA Section 3.4.2.2.2, the applicant stated that the One-Time Inspection Program and Plant Chemistry Program manage the aging effect. Exceptions apply to GALL Report recommendations for the Plant Chemistry Program implementation (refer to LRA Section B2.1.25). The One-Time Inspection Program is a new AMP. The scope of this new AMP will incorporate activities to verify the effectiveness of the Plant Chemistry Program, including a sample of components where the flow of water is low or stagnant conditions exist (refer to LRA Section B2.1.23). Implementation of the One-Time Inspection Program, in conjunction with the Plant Chemistry Program, to manage the aging effect provides added assurance that the aging effect is not occurring at locations of stagnant or low flow; or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The applicant stated in the LRA that the Plant Chemistry Program manages the loss of material for carbon and stainless steel components in SPC systems, and that a one-time inspection of selected components and susceptible locations will verify the efficacy of that program. SER Sections 3.0.3.2.19 and 3.0.3.1.4 document the staff's evaluations of the Plant Chemistry Program and One-Time Inspection Program, respectively.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.4.2.2.2. For those line items that apply to LRA Section 3.4.2.2.2, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.3 Loss of Material Due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling

The staff reviewed LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3.

In LRA Section 3.4.2.2.3, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.4.2.2.3 states that loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur in carbon steel piping and fittings for untreated water from the backup water supply in the PWR auxiliary FW (AFW) system. SRP-LR Table 3.3-1 states that further evaluation for this aging effect is for PWR plants only.

The staff found that this aging effect is not applicable at MNGP.

3.4.2.2.4 General Corrosion

The staff reviewed LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4.

In LRA Section 3.4.2.2.4 the applicant addressed loss of material due to general corrosion on the external surfaces of carbon steel and cast iron components of the SPC system in air/gas environments.

SRP-LR Section 3.4.2.2.4 states the following:

> Loss of material due to general corrosion could occur on the external surfaces of all carbon steel structures and components, including closure bolting, exposed to operating temperature less that 212 °F. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

In LRA Section 3.4.2.2.4, the applicant stated that the System Condition Monitoring Program manages the loss of material for carbon steel and cast iron components in SPC systems. The System Condition Monitoring Program manages the aging effect on the external surfaces of carbon steel and cast iron components in air/gas environments. Management of the aging effect associated with certain components of the CDR with the plateout and holdup of radioactive material intended function is not applicable, as the CDR structural integrity is demonstrated continuously during normal plant operation. As documented in its August 31, 2005, letter, the applicant stated that it will revise the LRA to eliminate reference to the pressure boundary function of the CDRs as this function is inappropriate for these components. The System Condition Monitoring Program is an existing plant-specific program that manages aging effects for normally accessible external surfaces of piping, tanks, and other components and equipment within the scope of license renewal through visual inspection and monitoring of external surfaces for leakage and evidence of material degradation. Implementation of the System Condition Monitoring Program to manage corrosion adds assurance that corrosion does not occur and that the aging effect progresses so slowly that the component's intended function will be maintained during the period of extended operation. SER Section 3.0.3.3.2 documents the staff's review of the applicant's System Condition Monitoring Program.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.4.2.2.4. For those line items that apply to LRA Section 3.4.2.2.4, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The staff reviewed LRA Section 3.4.2.2.5 against the criteria in SRP-LR Section 3.4.2.2.5.

The applicant stated in LRA Section 3.4.2.2.5.2 that MNGP CSTs are not SR and therefore not within the scope of licensing renewal. The applicant also stated in LRA Section 3.4.2.2.5.2 that MNGP has no underground CSTs.

Because the applicant has no components from this group, the staff concurred with the applicant's determination that this aging effect is not applicable.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.4.2-1 through 3.4.2-5, the staff reviewed additional details of the results of the AMRs for material, environment, AERM, and AMP combinations that are not consistent with the GALL Report, or that are not addressed in the GALL Report.

In LRA Tables 3.4.2-1 through 3.4.2-5, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report and provided information concerning how it will manage the aging effect. Specifically, Note F indicates that the GALL Report does not evaluate the material for the AMR line item component. Note G indicates that the GALL Report does not evaluate the environment for the AMR line item component and material. Note H indicates that the GALL Report does not evaluate the aging effect for the AMR line item component, material, and environment combination. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that the GALL Report does not evaluate either the component or the material and environment combination for the line item.

Staff Evaluation. For component type, material, and environment combinations that the GALL Report does not evaluate, the staff reviewed the applicant's evaluation to determine whether the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation. This section addresses AMR results for which LRA Tables 3.4.2-1 through 3.4.2-5 identified no aging effects. The discussion on each table addresses the other line items that are not consistent with the GALL Report or not addressed in the GALL Report. The following sections discuss the staff's evaluation.

In LRA Tables 3.4.2-1 through 3.4.2-5, the applicant identified AMR line items for which the aging review process identified no aging effects. Specifically, the applicant identified no aging effects for components fabricated from stainless steel and rubber materials that are exposed to a primary containment air, plant indoor air, instrument air, or gas environment or for components fabricated from carbon steel or stainless steel that are exposed to a lubricating oil environment. The applicant stated that a materials science evaluation for these materials in these environments discovered no aging effects.

Because stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as cited in the *Metals Handbook*, Ninth Edition, the staff agreed that stainless steel in an indoor, uncontrolled air environment (e.g., plant indoor air) or in a gas environment (e.g., primary containment air inerted with nitrogen) exhibits no aging effect and that the SC will, therefore, remain capable of performing its intended functions consistent with the CLB for the period of extended operation. In addition, because both oxygen and moisture must be present to corrode steel, as cited in the *Metals Handbook,* the staff agreed that carbon steel or stainless steel in a lubricating oil internal environment with no water pooling exhibits no aging effect and that the SC will, therefore, remain capable of performing its intended functions consistent with the CLB for the period of extended operation.

As listed in the GALL Report, rubber that is not in an environment of elevated temperature (i.e., above 95 °F (35 °C)) with additional factors such as exposure to ozone, oxidation, and radiation will remain capable of performing intended functions consistent with the CLB for the period of extended operation. Because specific ozone concentrations could not be determined, by letter dated November 17, 2005, the applicant stated that it will manage change in material properties due to ozone for elastomers in an external air environment using the System Condition Monitoring Program. SER Section 3.4.2.3.3 documents the staff's evaluation.

The staff's review of current industry research and operating experience found that plant indoor air, primary containment air, instrument air on stainless steel, or lubricating oil on stainless steel or carbon steel will not result in aging of concern during the period of extended operation; therefore, the staff concluded that the component, material, and environment combinations described in the preceding discussion have no applicable AERMs.

The staff's review of current industry research and operating experience found that the applicant demonstrated that no aging effects are predicted for the material and environmental combinations reported and that the SPC system components fabricated from these materials in the environments listed above will maintain their intended functions consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.1 Steam and Power Conversion System—Condensate Storage System—Summary of Aging Management Evaluation—Table 3.4.2-1

The staff reviewed LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the condensate storage system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.4.2.3 above.

3.4.2.3.2 Steam and Power Conversion System—Condensate and Feedwater System—Summary of Aging Management Evaluation—Table 3.4.2-2

The staff reviewed LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the condensate and FW system component groups.

In LRA Table 3.4.2-2, the applicant proposed to manage cracking and change in material properties due to thermal exposure of rubber materials for the component types of expansion joints exposed to a treated water (internal) environment using the One-Time Inspection Program.

SER Section 3.0.3.1.4 documents the staff's review of the One-Time Inspection Program. The One-Time Inspection Program is a new program consistent with the recommendations of GALL AMP XI.M32". This program will include measures to verify the effectiveness of the Plant Chemistry Program and the Fuel Oil Chemistry Program and also will confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within scope of license renewal. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs. The applicant has noted in the LRA that in some cases in which aging effects/mechanisms are not expected to be significant, the One-Time Inspection Program alone is credited with managing aging effects. The staff's review determined that the use of the One-Time Inspection Program alone is acceptable in certain cases in which the use of the Plant Chemistry Program is not a viable option. This AMP is appropriate for the aging effects/mechanisms identified and assures effective management of the aging effects through the period of extended operation.

The staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience determined that the One-Time Inspection Program effectively manages the aging effects of cracking and change in material properties due to thermal exposure of rubber material exposed to a treated water (internal) environment. On this basis, the staff found that management of cracking due to thermal exposure, as given in LRA Table 3.4.2-2, is acceptable.

3.4.2.3.3 Steam and Power Conversion System—Main Condenser System—Summary of Aging Management Evaluation—Table 3.4.2-3

The staff reviewed LRA Table 3.4.2-3, which summarizes the results of AMR evaluations for the CDR system component groups.

In Table 3.4.2-2, the applicant identified no AERMs for rubber expansion joints intended to maintain the pressure boundary function in a plant indoor air environment. The applicant stated that the GALL Report does not evaluate either the components or the material and environment combination. The applicant further stated that these elastomer components (e.g., neoprene, rubber) are indoors and not subject to UV rays or ozone, nor are they in locations subject to radiation exposure or to temperatures at which changes in material properties or cracking could occur (>95 °F); therefore, the applicant contended that no aging management is required. In industry experience, however, elastomeric expansion joints degrade due to oxidation in environments that are not necessarily harsh, as discussed in EPRI Report 1008035 and EPRI Report 1007933.

The staff's review of LRA Section 3.4 identified areas for which it needed additional information to complete its evaluation of the applicant's results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.4-1, dated July 20, 2005, the staff requested that the applicant discuss its inspection procedures for the rubber expansion joints related to preventive maintenance, for both external and internal surfaces of the elastomer.

In its response, by letter dated August 16, 2005, the applicant stated the following:

> EPRI Report 1008035, 'Expansion Joint Maintenance Guide,' Revision 1, May 2003, Table 5-4, rates elastomers against oxidation, tensile strength, and radiation. Elastomers, such as Neoprene, Natural Rubber, Chlorobutyl, Buna-N, Viton, and EPDM, are rated as good or better in the categories of oxidation, tensile strength, and radiation.
>
> EPRI Report 1007933, 'Aging Assessment Field Guide,' December 2003, pages 60 through 65, lists oxidation as a degradation mechanism brought on by the stressors: Thermal, Radiation, and Ultraviolet. As stated in the first paragraph of the question, these elastomers are not exposed to these stressors.
>
> Since these elastomers are not exposed to ultraviolet, radiation, or temperatures >95 degrees F, they are therefore not susceptible to oxidation and no aging management is required.

In addition, the applicant referred to a related response to RAI 3.3.2.3-3, which addresses the oxidation effects and degradation of elastomers due to thermal, irradiation, and UV exposure.

The staff also noted that the applicant's response to RAI 3.3.2.3-4, dated August 16, 2005, had not addressed degradation of rubber by oxidation resulting from exposure to ozone in air. The staff asked the applicant to provide the specific designation of the types of elastomers installed at the plant and the data related to exposure to ozone in air for each type, if available. In addition, the staff asked the applicant to explain its method for evaluating degradation caused by oxidation from exposure to ozone.

The staff was concerned that some of the elastomers in question may not be long-lived components designed for 60 years. The applicant's response had not clearly stated that these components are not long-lived and are replaced at specified intervals. The staff asked the applicant to confirm this and provide supporting data.

In its response, by letter dated November 17, 2005, the applicant stated the following:

> After further evaluation of this issue, NMC has taken the conservative approach of managing change in material properties due to ozone for elastomers in an air environment, specifically for natural rubber. This is a result of the fact that neither representative ozone concentrations nor technically substantiated thresholds could be adequately or consistently determined, even though plant specific operating experience has indicated that there has been no change in material properties due to ozone for these elastomer components. Further evaluation also revealed the inability to confirm that none of these components are fabricated from natural rubber.
>
> As a result, elastomers in an external air environment in the following LRA tables will utilize the System Condition Monitoring Program to manage the potential aging effect of changes in material properties due to ozone which shall be assigned to these components.

- Table 3.3.2-3 expansion joints in the Circulating Water System
- Table 3.3.2-5 piping and fittings in the Demineralized Water System
- Table 3.3.2-6 piping and fittings in the Emergency Diesel Generators System
- Table 3.3.2-7 ventilation seals in the Emergency Filtration Train System
- Table 3.3.2-16 expansion joints in the Service and Seal Water System
- Table 3.4.2-2 expansion joints in the Condensate and Feedwater System (those which were not previously managed externally)

Elastomers in Table 3.2.2-8 (ventilation seals in the Secondary Containment System) are presently being managed utilizing the One-Time Inspection Program for the internal surfaces and the System Condition Monitoring Program for the external surfaces. These Aging Management Programs (AMPs) were initially credited to manage change in material properties and cracking due to thermal exposure, since a temperature threshold of greater than 95 °F was assigned to these components. Consequently, these same AMPs will also manage change in material properties due to ozone which shall be assigned to these components.

Elastomers (expansion joints) in Table 3.4.2-3 (Main Condenser System) do not require aging management since these components do not serve a pressure boundary intended function but provide for plate-out and holdup of radioactive material during design basis events. Condenser integrity is continuously demonstrated during normal plant operation thus validating that this intended function is maintained as stated in the plant-specific notes for these components in Section 3.4 of the LRA.

Elastomers in an internal air environment in Table 3.3.2-6 (piping and fittings in the Emergency Diesel Generators System) and Table 3.3.2-7 (ventilation seals in the Emergency Filtration Train System) will utilize the One-Time Inspection Program to manage the potential aging effect of change in material properties due to ozone which shall be assigned to these components.

Elastomers in both an internal and external air environment in Table 3.3.2-11 (ventilation seals in the Heating and Ventilation System) were inadvertently omitted from this table. These components shall be managed for the potential aging effect of change in material properties due to ozone utilizing the One-Time Inspection Program for the internal surfaces and the System Condition Monitoring Program for the external surfaces which shall be assigned to these components.

All the elastomers addressed are long-lived components. Any component that is not long-lived and replaced at specified intervals is eliminated from AMR consideration during the screening process. Although the expansion joints are presently under review for replacement on a fixed periodicity, this change has not been effected and they remain as and have been analyzed as long-lived components.

Any degradation of elastomer components in an air environment resulting from change in material properties due to ozone for the external surfaces of these components shall be evaluated as discussed in the response to RAI B2.1.32-02 which addresses the System Condition Monitoring AMP.

The staff's review found the applicant's response acceptable, because the applicant added the System Condition Monitoring and One-Time Inspection Programs for the management of aging effects in elastomers. The applicant also satisfactorily addressed the staff's concern related to long-lived components. SER Sections 3.0.3.3.2 and 3.0.3.1.4 document the staff reviews of the System Condition Monitoring and One-Time Inspection Programs, respectively; therefore, the staff's concern described in RAI 3.3.2.3-4 is resolved.

In RAI 3.4-2, dated July 20, 2005, the staff noted that in LRA Table 3.4.2-3 the applicant identified the aging effects of changes in material properties and cracking due to irradiation and thermal exposure for rubber expansion joints in an internal steam environment. The intended function of the expansion joints is to maintain holdup of radioactive material. The applicant stated that the GALL Report does not evaluate either the components or the material and environment combination. The applicant further stated that the aging effect/mechanism is applicable but requires no management as the intended function for this component is post-accident iodine plateout and holdup. According to the applicant, CDR structural integrity is continuously demonstrated during normal plant operation, thus maintaining the intended function; however, the staff position is that this component type (rubber expansion joint) is within the scope of license renewal and its aging effects should be managed. The staff requested that the applicant provide the appropriate AMP to manage the aging effects of changes in material properties and cracking due to irradiation and thermal expansion of the rubber expansion joints in a steam environment.

In its response, by letter dated August 16, 2005, the applicant further demonstrated that the post-accident plateout and holdup of radioactive material intended function will be maintained and no aging management is required. The applicant stated the following:

For both a Loss of Coolant Accident (LOCA) and a Control Rod Drop Accident (CRDA), radioactive iodine is assumed to be held up and plate-out on the interior surfaces of the main condenser. 'Plate-out and holdup of radioactive material' is the only intended function assigned to the main condenser expansion joints.

Aging management is not required for the main condenser components that have only a plate-out and holdup of radioactive material intended function. For these components, the aging effects do not require aging management because the deposition of iodine in the main condenser is unaffected by the condenser surface condition. To maintain the intended function, the main condenser and the components, which make up the main condenser complex, simply have to remain intact.

Condenser structural integrity is continuously demonstrated during normal operation when the condenser is required to maintain vacuum. Following a design basis accident, when the condenser is required to perform its intended function, the main steam isolation valves will be closed and vacuum will be lost. The condenser will not be required to perform a pressure boundary function because atmospheric conditions will exist inside the condenser.

Since normal performance considerations such as fouling and in-leakage (e.g., circulating water or air leaks) place greater requirements on condenser operation than the post-accident plate-out, then as long as the condenser is intact and operational, the post-accident plate-out and holdup of radioactive material intended function will be maintained and no aging management is required.

The staff's review found the applicant's response to RAI 3.4-2 acceptable because the condenser is likely to remain operational following a DBA as well as during normal operation, and no aging management is required; therefore, the staff's concern described in RAI 3.4-2 is resolved.

3.4.2.3.4 Steam and Power Conversion System—Main Steam System—Summary of Aging Management Evaluation—Table 3.4.2-4

The staff reviewed LRA Table 3.4.2-4, which summarizes the results of AMR evaluations for the MST system component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.4.2.3 above.

3.4.2.3.5 Steam and Power Conversion System—Turbine Generator System—Summary of Aging Management Evaluation—Table 3.4.2-5

The staff reviewed LRA Table 3.4.2-5, which summarizes the results of AMR evaluations for the turbine generator system component groups.

In LRA Table 3.4.2-5, the applicant proposed to manage the loss of material due to selective leaching of cast iron materials for the component types of steam traps exposed to a treated water or steam (internal) environment, or for copper alloy component types of heat exchangers exposed to a wet air or gas environment, or for component types of piping and fittings exposed to a raw water environment, using the Selective Leaching of Materials Program.

SER Section 3.0.3.2.22 documents the staff's review and evaluation of the applicant's Selective Leaching of Materials Program. The Selective Leaching of Materials Program includes a one-time visual inspection and hardness measurement of certain components susceptible to selective leaching. In situations in which hardness testing is not practical, the applicant will use a qualitative approach by other NDE or metallurgical methods to determine the presence and extent of selective leaching. The program will determine if selective leaching occurs for certain components and ensure the integrity of components made of gray cast iron, bronze, brass, and other alloys exposed to a raw water, treated water, or ground-water environment that may cause selective leaching of one of the metal components. The staff's review found this AMP adequate for managing this material, environment, and aging effect combination.

In LRA Table 3.4.2-5, the applicant proposed to manage the loss of material due to MIC, pitting, and crevice corrosion of copper alloy materials for the component types of gauges, piping and fittings, and valve bodies exposed to a treated water (internal) environment using the One-Time Inspection Program and the Plant Chemistry Program.

SER Sections 3.0.3.2.19 and 3.0.3.1.4 document the staff's reviews of the applicant's Plant Chemistry Program and the One-Time Inspection Program, respectively. The Plant Chemistry Program mitigates the aging effects on component surfaces that are exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits. The One-Time Inspection Program is a new program consistent with the recommendations of GALL AMP XI.M32 and verifies the effectiveness of the Plant Chemistry Program. The One-Time Inspection Program addresses concerns and provides confirmation for the potential long incubation period for certain aging effects on SCs. The staff review determined that the Plant Chemistry Program supplemented by the One-Time Inspection Program is adequate for managing these combinations of material, environment, and aging effects.

In LRA Table 3.4.2-5, the applicant proposed to manage loss of material due to MIC, pitting, and crevice corrosion of copper alloy materials for the component types of heat exchangers exposed to a wet air or gas (external) environment using the System Condition Monitoring Program.

SER Section 3.0.3.3.2 documents the staff's review and evaluation of the applicant's System Condition Monitoring Program.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the Plant Chemistry Program, One-Time Inspection Program, and System Condition Monitoring Program effectively manage the aging effect of loss of material due to MIC, pitting, and crevice corrosion of copper alloy material exposed to wet air or gas, or treated water environment. The Selective Leaching of Materials Program effectively manages the loss of material due to selective leaching of cast iron material exposed to treated water environment, and copper alloy exposed to wet air or gas and raw water environments. The staff found that the applicant's program to manage loss of material due to MIC, pitting, crevice corrosion, and selective leaching, as given in LRA Table 3.4.2-5, is acceptable.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, AERMs, and AMP combinations that the GALL Report does not evaluate. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the SPC system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concluded that they adequately describe the AMPs credited for managing aging of the SPC system, as required by 10 CFR 54.21(d).

3.5 Aging Management of Containments, Structures, and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the containments, structures, and component supports components and component groups associated with the following systems:

- cranes, heavy loads, rigging
- diesel fuel oil transfer house
- emergency diesel generator building
- emergency filtration train building
- fire protection barriers commodity group
- hangers and supports commodity group
- HPCI building
- intake structure
- miscellaneous SBO yard structures
- offgas stack
- offgas storage and compressor building
- plant control and cable spreading structure
- primary containment
- radioactive waste building
- reactor building
- structures affecting safety
- turbine building
- underground duct bank

3.5.1 Summary of Technical Information in the Application

In LRA Section 3.5, the applicant provided AMR results for the containments, structures, and component supports components and component groups. In LRA Table 3.5.1, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the containments, structures, and component supports components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a

review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine if the applicant provided sufficient information to demonstrate that the aging effects for the containments, structures, and component supports system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In addition, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs are consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant had identified the appropriate GALL Report AMRs. SER Section 3.0.3 documents the staff's evaluations of the AMPs. The MNGP audit and review report details the staff's audit evaluation, as summarized in SER Section 3.5.2.1.

The staff also performed an onsite audit of those selected AMRs that are consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the acceptance criteria in SRP-LR Section 3.5.2.2. The MNGP audit and review report documents the staff's audit evaluations, which and are summarized in SER Section 3.5.2.2.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that are not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether the applicant identified all plausible aging effects and whether the aging effects listed are appropriate for the combination of materials and environments specified. The MNGP audit and review report documents the staff's audit evaluations. SER Section 3.5.2.3 summarizes these audit evaluations and documents the staff's technical review.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the containments, structures, and component supports system components.

Table 3.5-1 below summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.5 that are addressed in the GALL Report.

Table 3.5-1 Staff Evaluation for Containments, Structures, and Component Supports in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Common Components of All Types of PWR and BWR Containment				
Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-01)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components and Section 4.6, Fatigue Analysis of the Primary Containment, Attached Piping, and Components
Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-02)	Cracking due to cyclic loading, or crack initiation and growth due to SCC	Containment ISI, containment leak-rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends further evaluation (see Section 3.5.2.2.1)
Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-03)	Loss of material due to corrosion	Containment ISI, containment leak-rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends no further evaluation
Personnel airlock and equipment hatch (Item Number 3.5.1-04)	Loss of material due to corrosion	Containment ISI, containment leak-rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends no further evaluation
Personnel airlock and equipment hatch (Item Number 3.5.1-05)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanism	Containment leak-rate test, plant Technical Specifications	10 CFR 50, Appendix J Program (B2.1.1)	Consistent with GALL Report, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Seals, gaskets, and moisture barriers (Item Number 3.5.1-06)	Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers	Containment ISI, containment leak-rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends no further evaluation
PWR Concrete (Reinforced and Prestressed) and Steel Containment **BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment**				
Concrete elements —foundation, walls, dome (Item Number 3.5.1-07)	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI		Not applicable to MNGP Mark I containment
Concrete elements —foundation (Item Number 3.5.1-08)	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring		Not applicable to MNGP Mark I containment
Concrete elements —foundation (Item Number 3.5.1-09)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring		Not applicable to MNGP Mark I containment
Concrete elements —foundation, dome, and wall (Item Number 3.5.1-10)	Reduction of strength and modulus due to elevated temperature	Plant specific		Not applicable to MNGP Mark I containment
Prestressed containment —tendons and anchorage components (Item Number 3.5.1-11)	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA, evaluated in accordance with 10 CFR 54.21(c)		Not applicable to MNGP Mark I containment
Steel elements —liner plate, containment shell (Item Number 3.5.1-12)	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI, containment leak-rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends further evaluation (see Section 3.5.2.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel elements —vent header, drywell head, torus, downcomers, pool shell (Item Number 3.5.1-13)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components and Section 4.6, Fatigue Analysis of the Primary Containment, Attached Piping, and Components
Steel elements—protected by coating (Item Number 3.5.1-14)	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26), Protective Coating Monitoring & Maintenance Program (B2.1.27)	Consistent with GALL Report. Protective Coating Monitoring & Maintenance Program is not relied upon for managing loss of material due to corrosion, but is credited for preventing degradation of coatings that could lead to clogging of ECCS suppression pool suction strainers
Prestressed containment—tendons and anchorage components (Item Number 3.5.1-15)	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI		Not applicable to MNGP Mark I containment. There are no prestressed containment tendons and anchorage components
Concrete elements —foundation, dome, and wall (Item Number 3.5.1-16)	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI		Not applicable to MNGP Mark I containment

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel elements —vent line bellows, vent headers, downcomers (Item Number 3.5.1-17)	Cracking due to cyclic loads or crack initiation and growth due to SCC	Containment ISI, containment leak-rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends further evaluation (see Section 3.5.2.2.1)
Steel elements—suppression chamber liner (Item Number 3.5.1-18)	Crack initiation and growth due to SCC	Containment ISI, containment leak-rate test		Not applicable to MNGP Mark I containment
Steel elements —drywell head and downcomer pipes (Item Number 3.5.1-19)	Fretting and lockup due to wear	Containment ISI		Not applicable to MNGP. Components not subject to relative motion
Class I Structures				
All groups except Group 6 —accessible interior/exterior concrete and steel components (Item Number 3.5.1-20)	All types of aging effects	Structures Monitoring	Structures Monitoring Program (B2.1.31)	Consistent with GALL Report, which recommends further evaluation (see Section 3.5.2.2.2)
Groups 1–3, 5, 7–9 —inaccessible concrete components, such as exterior walls below grade and foundation (Item Number 3.5.1-21)	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant specific	None MNGP meets the criteria specified in the GALL Report	Consistent with GALL Report, which recommends further evaluation (see Section 3.5.2.2.2)
Group 6—all accessible/ inaccessible concrete, steel, and earthen components (Item Number 3.5.1-22)	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of water-control structures or FERC/U.S. Army Corp of Engineers dam inspection and maintenance	Structures Monitoring Program (B2.1.31)	Consistent with GALL Report, with enhancements in the Structures Monitoring Program to include RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants.

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Group 5—liners (Item Number 3.5.1-23)	Crack initiation and growth from SCC and loss of material due to crevice corrosion	Water chemistry and monitoring of spent fuel pool water level	Plant Chemistry Program (B2.1.25), Primary Containment In-Service Inspection Program (B2.1.26), and System Condition Monitoring Program (B2.1.32)	Consistent with GALL Report, which recommends no further evaluation
Groups 1–3, 5, 6—all masonry block walls (Item Number 3.5.1-24)	Cracking due to restraint, shrinkage, creep, and aggressive environment	Masonry wall	Fire Protection Program (B2.1.17), Structures Monitoring Program (B2.1.31)	Consistent with GALL Report, with enhancements in the Structures Monitoring Program to include masonry walls
Groups 1–3, 5, 7–9—foundation (Item Number 3.5.1-25)	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	Structures Monitoring Program (B2.1.31) only for the fuel oil transfer house	Consistent with GALL Report (see Section 3.5.2.2.1)
Groups 1–3, 5–9—foundation (Item Number 3.5.1-26)	Reduction in foundation strength due to erosion of porous concrete *subfoundation*	Structures monitoring	None MNGP meets the criteria specified in *the GALL Report*	Consistent with GALL Report (see Section 3.5.2.2.1)
Groups 1–5—concrete (Item Number 3.5.1-27)	Reduction of strength and modulus due to elevated temperature	Plant specific	None Concrete temperatures do not exceed GALL Report recommended limits	Consistent with GALL Report, which recommends further evaluation (see Section 3.5.2.2.1)
Groups 7, 8—liners (Item Number 3.5.1-28)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Plant specific		Not applicable. MNGP has no Group 7 (concrete tanks) or Group 8 (steel tanks) with liners
Component Supports				

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
All groups—support members—anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc. (Item Number 3.5.1-29)	Aging of component supports	Structures Monitoring	Buried Piping & Tanks Inspection Program (B2.1.5), Primary Containment In-Service Inspection Program (B2.1.26), Structures Monitoring Program (B2.1.31), System Condition Monitoring Program (B2.1.32)	Consistent with GALL Report, which recommends further evaluation (see Section 3.5.2.2.3)
Groups B1.1, B1.2, and B1.3—support members—anchor bolts, welds (Item Number 3.5.1-30)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)		This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components
All groups—support members—anchor bolts, welds (Item Number 3.5.1-31)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable, PWR only
Groups B1.1, B1.2, and B1.3—support members—anchor bolts, welds, spring hangers, guides, stops, and vibration isolators (Item Number 3.5.1-32)	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	ASME Section XI, Subsection IWF Program (B2.1.3)	Consistent with GALL Report, which recommends no further evaluation
Group B1.1—high-strength low-alloy bolts (Item Number 3.5.1-33)	Crack initiation and growth due to SCC	Bolting integrity		Not applicable to MNGP. There are no high-strength low-alloy bolts in use at MNGP for structural applications

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in SER Section 3.5.2.1, involves the staff's review of the AMR results for components in the containments, structures, and component supports that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in SER Section 3.5.2.2, involves the staff's review of the AMR results for components in the containments, structures, and component supports that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.5.2.3, involves the staff's review of the AMR results for components in the containments, structures, and component supports that the applicant indicated are not consistent with, or not addressed in, the GALL Report. Section 3.0.3 documents the staff's review of AMPs that are credited to manage or monitor aging effects of the containments, structures, and component supports components.

3.5.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.5.2.1, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the containments, structures, and component supports system components:

- 10 CFR 50, Appendix J Program (B2.1.1)
- ASME Section XI, Subsection IWF Program (B2.1.3)
- Buried Piping & Tanks Inspection Program (B2.1.5)
- Fire Protection Program (B2.1.17)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B2.1.22)
- One-Time Inspection Program (B2.1.23)
- Plant Chemistry Program (B2.1.25)
- Primary Containment In-Service Inspection Program (B2.1.26)
- Protective Coating Monitoring & Maintenance Program (B2.1.27)
- Structures Monitoring Program (B2.1.31)
- System Condition Monitoring Program (B2.1.32)

Staff Evaluation. In LRA Tables 3.5.2-1 through 3.5.2-18, the applicant summarized the AMRs for the containments, structures, and component supports components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation the staff performed an audit and review to determine whether the GALL Report evaluation bounds the plant-specific components contained in these GALL Report component groups.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component applies to the component under review. The staff verified that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but the applicant credited a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP will manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs. The following sections discuss the staff's evaluation.

3.5.2.1.1 Loss of Material Due to Corrosion in Accessible Areas

In reviewing entries in LRA Table 3.5.2-13 for carbon steel and low-alloy steel in treated water and air/gas environments, the staff identified some discrepancies in notes for AMR line items that reference GALL Report line item II.B.1.1.1-a. The discrepancies resulted because the applicant credited different AMPs from those recommended by the GALL Report and used exceptions where none existed. The staff asked the applicant to resolve these discrepancies. In its response, by letter dated August 11, 2005, the applicant stated the following:

> LRA line II.B.1.1.1-a for the component structural steel in a treated water environment for the AMP Primary Containment Inservice Inspection program, the note should have been 'C' and not 'D.'
>
> LRA line II.B.1.1.1-a for the component structural steel in a treated water environment for the AMP Plant Chemistry program, the note should have been 'E' and not 'D.'
>
> LRA line II.B.1.1.1-a for the component support members, welds, bolted connections, torus internal catwalk support columns in a treated water environment for the AMP Primary Containment Inservice Inspection program, the note should have been 'C' and not 'D.'
>
> LRA line II.B.1.1.1-a for the component support members, welds, bolted connections, torus internal catwalk support columns in a treated water environment for the AMP Plant Chemistry Program, the note should have been 'E' and not 'D.'
>
> LRA line II.B.1.1.1-a for the component structural steel inside torus, torus internal catwalk in an air/gas environment, for the AMP Primary Containment Inservice Inspection Program, the note should have been 'C' and not 'D.'

Because the components, material, and AMP identified in the LRA are consistent with the GALL Report, the staff concluded that the applicant appropriately addressed aging management for the above components.

The staff's review found that the applicant appropriately addressed the aging effects/mechanisms, as recommended by the GALL Report.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. The staff's review concluded that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report; therefore, the staff concluded that the applicant has demonstrated that the aging effects for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application. In LRA Section 3.5.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the containments, structures, and component supports components. The applicant provided information concerning how it will manage the following aging effects for PWR and BWR containments:

- aging of inaccessible concrete areas
- cracking, distortion, and increase in component stress level due to settlement; reduction of foundation strength due to erosion of porous concrete subfoundations, if not covered by the Structures Monitoring Program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to corrosion in inaccessible areas of steel containment shell or liner plate
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to cyclic loading and SCC

The applicant also provided information on its management of the following aging effects for Class 1 structures:

- aging of structures not covered by the Structures Monitoring Program
- aging management of inaccessible areas

Finally, the applicant provided information on its management of aging effects for component supports:

- aging of supports not covered by the Structures Monitoring Program
- cumulative fatigue damage due to cyclic loading

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addresses the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.5.2.2. The staff's audit and review report details the staff's audit. The following sections discuss the staff's evaluation of the aging effects.

3.5.2.2.1 PWR and BWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which addresses several areas discussed below.

Aging of Inaccessible Concrete Areas. The staff reviewed LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1.

In LRA Section 3.5.2.2.1.1, the applicant addressed aging of inaccessible concrete areas.

SRP-LR Section 3.5.2.2.1.1 states the following:

> Cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack; and cracking, spalling, loss

of bond, and loss of material due to corrosion of embedded steel could occur in inaccessible areas of PWR concrete and steel containments; BWR Mark II concrete containments; and Mark III concrete and steel containments. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In LRA Section 3.5.2.2.1.1, the applicant stated that these aging effects/mechanisms do not apply to the MNGP containment because it is a BWR Mark I design, which does not include concrete as part of the containment structure. The staff found that these aging effects/mechanisms do not apply for the MNGP containment.

Cracking, Distortion, and Increase in Component Stress Level Due to Settlement; Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundations, If Not Covered by the Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2.

In LRA Section 3.5.2.2.1.2, the applicant addressed cracking, distortion, and increase in component stress level due to settlement as well as reduction of foundation strength due to erosion of porous concrete subfoundations.

SRP-LR Section 3.5.2.2.1.2 states the following:

> Cracking, distortion, and increase in component stress level due to settlement could occur in PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments. Also, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. Some plants may rely on a de-watering system to lower the site ground-water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

In LRA Section 3.5.2.2.1.2, the applicant addressed aging effects due to settlement, specifically whether it needs to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report.

This subsection mainly concerns PWR and BWR Mark II and III concrete containments; however, the settlement criteria presented apply to all concrete foundations. The plant initial licensing basis did not include a program to monitor settlement. With the exception of the diesel fuel oil transfer house, no significant settlement has been observed on any major structure, and de-watering systems are not used. These circumstances satisfy the GALL Report recommendations on concrete settlement and, therefore, with the exception of the diesel fuel oil transfer house, cracks, distortion, and increase in component stress levels due to settlement require no aging management.

The diesel fuel oil transfer house is a moderate-weight structure exerting a mean bearing pressure of about 1100 pounds per square foot (lb/ft^2) on the underlying foundation material.

The foundation material of compacted granular backfill underlain by stiff clay lenses and sandstone bedrock should not be susceptible to settlement under the load imposed. However, the diesel fuel oil transfer house has undergone significant differential settlement. According to plant records and settlement data, the diesel fuel oil transfer house settled rapidly following construction, which the applicant stated probably resulted from washout after a rainstorm and was long ago effectively complete. Data recorded annually since 1992 show no significant continued settlement of the structure.

The Structures Monitoring Program manages the aging effects for the diesel fuel oil transfer house. As part of the Structures Monitoring Program, the applicant performs an annual inspection of the diesel fuel oil transfer house for settlement to manage the aging effects of cracks, distortion, and increase in component stress level due to settlement. The inspection adds assurance that the aging effects do not occur or progress so slowly that the component's intended function will be maintained during the period of extended operation.

SER Section 3.0.3.2.23 documents the staff's evaluation of the Structures Monitoring Program. The staff found this program acceptable for managing the aging effects of cracks, distortion, and increase in component stress level due to settlement as it inspects for settlement.

The applicant also addressed the aging effects of all types of PWR and BWR containments due to erosion of porous concrete subfoundations, specifically whether it needs to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report. The applicant's response to erosion of cement from porous concrete subfoundations, as described in IN 97-11, "Cement Erosion from Containment Subfoundations at Nuclear Power Plants," dated March 21, 1997, and IN 98-26, "Settlement Monitoring and Inspection of Plant Structures Affected by Degradation of Porous Concrete Subfoundations," dated July 24, 1998, concluded that foundation materials contain no porous layers. The concrete base or lean concrete fill material beneath major building foundations contains no high-alumina cement. The applicant does not rely on a de-watering system to lower site ground water.

The applicant concluded that the GALL Report recommendations are satisfied for porous concrete subfoundations and therefore the aging effects due to erosion of porous concrete subfoundations necessitate no aging management.

The staff found the applicant's further evaluation of both settlement and erosion of porous concrete subfoundations acceptable because (1) the applicant monitors the effects of differential settlement of the diesel fuel oil transfer house during inspections under the Structures Monitoring Program, (2) the applicant has no porous concrete subfoundations, and (3) the applicant does not employ a de-watering system.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.2. For those line items that apply to LRA Section 3.5.2.2.1.2, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3.

In LRA Section 3.5.2.2.1.3, the applicant addressed reduction of strength and modulus of concrete structures due to elevated temperature.

SRP-LR Section 3.5.2.2.1.3 states the following:

> Reduction of strength and modulus of elasticity due to elevated temperatures could occur in PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments. The GALL Report recommends further evaluation if any portion of the concrete containment components exceeds specified temperature limits (i.e., general area temperature 66 °C [150 °F] and local area temperature 93 °C [200 °F]).

The applicant stated that this aging effect mainly concerns PWR and BWR Mark II and III concrete containments; however, the temperature criteria presented in this section apply to all concrete. Plant documents confirm that concrete elements are not subject to elevated temperatures in excess of 150 °F generally and 200 °F locally. Plant areas that bound high-temperature considerations are the drywell general area and biological shield wall piping penetration local area, which experience temperatures of 135 °F and 179 °F, respectively.

The staff's review determined that the applicant has evaluated the temperatures of hot piping penetrations considering the presence of insulation, which is credited with maintaining the penetration temperatures below the local limits of 200 °F. Insulation is included within the scope of license renewal and is subject to an AMR.

The staff found the applicant's AMRs consistent with the GALL Report in demonstrating that the temperatures do not exceed the temperatures recommended in the GALL Report for which evaluation is required.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.3. For those line items that apply to LRA Section 3.5.2.2.1.3, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Material Due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate. The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4.

In LRA Section 3.5.2.2.1.4, the applicant addressed loss of material due to corrosion for the drywell shell and the drywell support skirt in inaccessible areas (i.e., embedded in concrete).

SRP-LR Section 3.5.2.2.1.4 states the following:

> Loss of material due to corrosion could occur in inaccessible areas of the steel containment shell or the steel liner plate for all types of PWR and BWR

containments. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In LRA Section 3.5.2.2.1.4, the applicant stated that MNGP satisfies the requirements specified in the GALL Report for concrete quality, inspections, and housekeeping; therefore, a plant-specific AMP for loss of material due to corrosion of steel elements in inaccessible areas is not required.

The applicant also stated that the Protective Coating Monitoring & Maintenance Program is not credited with managing loss of material due to corrosion but with preventing degradation of coatings that could lead to clogging of ECCS suppression pool suction strainers. Implementation of this program to manage the aging effect adds assurance that the aging effect does not occur or progresses so slowly that the component's intended function will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.1.4 and determined that the applicant satisfied the specific criteria defined in the GALL Report for preventing loss of material due to corrosion for the drywell shell and the drywell support skirt in inaccessible areas (i.e., embedded in concrete). The staff's review of applicant documents specifying that (1) plant concrete meets ACI 318 or 349 criteria, (2) the Structures Monitoring Program inspects the concrete around the inside of the drywell adjacent to the moisture barrier, (3) the scope of the Primary Containment In-Service Inspection Program includes the moisture barrier, and (4) borated water leaks do not apply for BWR plants. Therefore, the staff determined that further evaluation is not necessary.

The staff found that the applicant is consistent with the GALL Report, and a plant-specific AMP for loss of material is not required. SER Section 3.5.2.3.6 documents further discussion of the staff's review of loss of material due to corrosion for the drywell shell in inaccessible areas.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.4. For those line items that apply to LRA Section 3.5.2.2.1.4, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.1.5 against the criteria in SRP-LR Section 3.5.2.2.1.5.

In LRA Section 3.5.2.2.1.5, the applicant addressed loss of prestress due to relaxation, shrinkage, creep, and elevated temperature.

SRP-LR Section 3.5.2.2.1.5 states the following:

> Loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

In LRA Section 3.5.2.2.1.5, the applicant stated that this aging effect applies to Mark II BWR containments only.

Because MNGP is not a PWR and has no BWR Mark II containment, the staff found this aging effect not applicable.

Cumulative Fatigue Damage. In LRA Section 3.5.2.2.1.6, the applicant stated that fatigue is a TLAA as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Sections 4.3 and 4.6 document the staff's review of the applicant's evaluation of this TLAA.

Cracking Due to Cyclic Loading and SCC. The staff reviewed LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7.

In LRA Section 3.5.2.2.1.7, the applicant addressed cracking due to cyclic loading and SCC.

SRP-LR Section 3.5.2.2.1.7 states the following:

> Cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading or SCC could occur in all types of PWR and BWR containments. Cracking could also occur in vent line bellows, vent headers, and downcomers due to SCC for BWR containments. A visual VT-3 examination would not detect such cracks. The GALL Report recommends further evaluation of the inspection methods implemented to detect these aging effects.

In LRA Section 3.5.2.2.1.7, the applicant listed components associated with primary containment that require aging management for cracking due to cyclic loading because their original design bases did not include CLB fatigue analyses. Specifically, components requiring aging management for cracking due to cyclic loading include drywell penetrations, drywell penetration sleeves, and associated dissimilar metal welds. These components are designed to stress levels without requiring fatigue analyses and thus fine cracks are unlikely to occur; therefore, existing requirements for leak-rate testing pursuant to the 10 CFR 50, Appendix J Program and surface inspections pursuant to the Primary Containment In-Service Inspection Program are adequate to detect cracking due to cyclic loading.

The applicant also listed components associated with primary containment that require aging management for crack initiation and growth due to SCC, specifically the stainless steel vent line bellows and drywell penetration bellows. The GALL Report states that weld Examination Categories E-B (pressure retaining welds, VT-1 examination method) and E-F (dissimilar pressure retaining welds, surface examination method) for vent line and other penetration bellows assemblies are warranted for the extended period of operations.

The applicant stated that its operating history on bellows replacements is limited to bellows X-16B. Leakage was identified during local leak-rate testing and not from cracks observed during a visual examination. The leakage was identified at the outer-most bellows from a small failure underneath the outer-most collar of the expansion joint. The applicant did not identify any cracks in the weld metal. Industry operating history has identified cracks of the bellows but none in the weld metal. Welds for bellows assemblies are in a sheltered, noncorrosive environment.

Additionally, bellows assemblies are located outside primary containment in an air/gas environment with temperatures not expected to exceed threshold limits for SCC. Because of the nonaggressive environmental exposures and plant-specific and industry operating histories, the applicant stated that weld examinations using optional Examination Categories E-B and E-F are not warranted. The applicant stated that existing requirements for visual examinations, in accordance with ASME Code, Section XI (Subsection IWE), Examination Category E-A, and Appendix J leak-rate testing, Examination Category E-P, should be sufficient to detect cracking of the bellows assemblies.

The applicant concluded that implementation of these programs to manage aging effects adds assurance that the aging effects do not occur or progress so slowly that the component's intended function will be maintained during the period of extended operation.

SER Sections 3.0.3.1.6 and 3.0.3.2.1 document the staff's reviews of the applicant's Primary Containment In-Service Inspection Program and the 10 CFR 50, Appendix J Program, respectively. The NRC staff found these programs acceptable for managing cracking due to cyclic loading and SCC in accessible areas.

The staff reviewed industry operating experience on cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading and SCC and found it to be similar to the applicant's operating experience. The staff concluded that the applicant appropriately addressed further evaluation of this aging effect.

On the basis of its review, the staff concluded that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.7. For those line items that apply to LRA Section 3.5.2.2.1.7, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2 Class 1 Structures

The staff reviewed LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which addresses several areas discussed below.

<u>Aging of Structures Not Covered by Structures Monitoring Program</u>. The staff reviewed LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

In LRA Section 3.5.2.2.2.1, the applicant addressed various aging effects for concrete and carbon steel components. The applicant specifically addressed whether it needs to manage the aging effects/mechanisms based on plant-specific review of the conditional requirements outlined in the GALL Report.

SRP-LR Section 3.5.2.2.2.1 states the following:

> The GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the Structures Monitoring Program. This includes (1) scaling, cracking, and spalling due to repeated freeze-thaw for Groups 1–3, 5, 7–9 structures; (2) scaling, cracking, spalling and

increase in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack for Groups 1–5, 7–9 structures; (3) expansion and cracking due to reaction with aggregates for Groups 1–5, 7–9 structures; (4) cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for Groups 1–5, 7–9 structures; (5) cracks, distortion, and increase in component stress level due to settlement for Groups 1–3, 5, 7–9 structures; (6) reduction of foundation strength due to erosion of porous concrete subfoundation for Groups 1–3, 5–9 structures; (7) loss of material due to corrosion of structural steel components for Groups 1–5, 7–8 structures; (8) loss of strength and modulus of concrete structures due to elevated temperatures for Groups 1–5; and (9) crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liner for Groups 7 and 8 structures. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program. Technical details of the aging management issue are presented in SRP-LR Subsection 3.5.2.2.1.2 for items (5) and (6) and Subsection 3.5.2.2.1.3 for item (8).

The applicant stated that, in accordance with the GALL Report for carbon steel in accessible areas, loss of material due to corrosion requires aging management. It performs aging management of carbon steel in accessible areas within the Structures Monitoring Program through general visual inspections. Protective coatings, including galvanization, are not relied upon to manage the aging effects.

The applicant also stated that the underground duct bank and intake structures include below-grade steel components. As the below-grade sides of the carbon steel components are not accessible, the condition of the accessible sides of the carbon steel components located in an atmosphere/weather, air/gas, or raw water environment, will be used to evaluate the condition of the inaccessible sides of the carbon steel components.

The applicant stated that, in accordance with the GALL Report and ISG-03, concrete in accessible areas requires aging management for the aging mechanisms of freeze-thaw, leaching of calcium hydroxide, reaction with aggregates, corrosion of embedded steel, and aggressive chemical attack. The applicant performs aging management of concrete in accessible areas through general visual inspections within the Structures Monitoring Program.

The applicant stated that concrete in inaccessible areas requires no aging management and provided justification in the following paragraphs from LRA Section 3.5.2.2.2.1:

> MNGP is located in a severe weathering region according to Figure 1 of ASTM C33-90, and therefore a freeze-thaw evaluation is required. Plant documents confirm that the concrete has an air content between 3 and 6%, and subsequent inspections performed on concrete in accessible areas did not exhibit degradation related to freeze-thaw. This evaluation satisfies GALL Report and ISG-03 condition requirements for concrete in inaccessible areas, and therefore loss of material and cracking due to freeze-thaw do not require aging management.
>
> Plant documents confirm that the concrete was constructed in accordance with the recommendations in ACI 201.2R-77 for durability. Additionally, there is no

flowing water acting on any below-grade concrete basemat or concrete wall. Building foundations may or may not fall below the ground-water table. For those below the ground-water table, evaluation shows that ground-water flow velocity is well below the threshold at which any significant erosion or leaching of calcium hydroxide is possible. This evaluation satisfies the GALL Report and ISG-03 condition requirements for concrete in inaccessible areas, and therefore increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide do not require aging management.

Tests and petrographic examinations performed according to ASTM C289-64 and ASTM C295 verified that aggregates used are not reactive. This satisfies the GALL Report and ISG-03 condition requirements for concrete in inaccessible areas, and therefore expansion and cracking due to reaction with aggregates do not require aging management.

The GALL Report and ISG-03's description of an aggressive environment is pH < 5.5, chlorides >500 ppm, or sulfates > 1500 ppm. Plant documents confirm that the below-grade environment is not aggressive (MNGP data indicates that the pH is > 7.0, the chlorides are < 100 ppm and the sulfates are < 100 ppm). The Structures Monitoring Program includes examinations of below-grade concrete when excavated for any reason. To ensure the below-grade environment remains non-aggressive, ground-water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. This satisfies the GALL Report and ISG-03 condition requirements for concrete in inaccessible areas, and therefore cracking, loss of bond, and loss of material due to corrosion of embedded steel do not require aging management. Based on the above rationale, increase in porosity and permeability, cracking, and loss of material due to aggressive chemical attack do not require aging management.

Finally, the applicant stated in LRA Section 3.5.2.2.2.1 that implementation of the Structures Monitoring Program to manage aging effects/mechanisms adds assurance that the aging effects do not occur or progress so slowly that the component's intended function will be maintained during the period of extended operation.

SER Section 3.0.3.2.23 documents the staff's evaluation of the Structures Monitoring Program.

The staff reviewed component/aging effect combinations and the need to manage the aging effects/mechanisms based on plant-specific review of the conditional requirements outlined in the GALL Report and determined that the applicant appropriately addressed these conditions. The staff's review of the applicant's evaluations found them acceptable.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1. For those line items that apply to LRA Section 3.5.2.2.2.1, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Aging Management of Inaccessible Areas. The staff reviewed LRA Section 3.5.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2.

In LRA Section 3.5.2.2.2.2, the applicant addressed aging management of inaccessible areas for Class 1 structures.

SRP-LR Section 3.5.2.2.2.2 states the following:

> Cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack, and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas. The GALL Report recommends further evaluation to manage these aging effects in inaccessible areas of Groups 1–3, 5, 7–9 structures, if specific criteria defined in the GALL Report cannot be satisfied.

In LRA Section 3.5.2.2.2.2 the applicant stated that it has no Group 7 or 8 structures; therefore, discussion of the aging effects for these structures is not required. For other structures, the applicant concluded that concrete in inaccessible areas requires no aging management for corrosion of embedded steel and aggressive chemical attack and provided justification in LRA Section 3.5.2.2.2.1.

The staff reviewed LRA Section 3.5.2.2.2.1 and found the specific criteria defined in the GALL Report satisfied; therefore, further evaluation is not necessary.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2. For those line items that apply to LRA Section 3.5.2.2.2.2, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.3 Component Supports

The staff reviewed LRA Section 3.5.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.3, which addresses several areas discussed below.

Aging of Supports Not Covered by the Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.3.1 against the criteria in SRP-LR Section 3.5.2.2.3.1.

In LRA Section 3.5.2.2.3.1, the applicant discussed aging of component supports, specifically whether it needs to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report.

SRP-LR Section 3.5.2.2.3.1 states the following:

> The GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the Structures Monitoring Program. This includes (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; (2) loss

of material due to environmental corrosion, for Groups B2-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the Structures Monitoring Program.

The applicant stated that component supports include structural elements connected to the building or its structures and extending to a system or system component for support or restraint. Component supports include support members, anchor bolts, welds, bolted connections, grout pads, and building concrete at locations of expansion and at grouted anchors. This boundary definition includes any vibration isolation elements. Spray or drip shields for equipment are included with component supports. In addition, electrical and instrumentation racks, electrical panels, cabinets and enclosures, lighting fixtures, tube track, conduit, and cable trays provide support and, thus, are included with component supports. Miscellaneous steel structures such as platforms, stairs, whip restraints, and masonry wall supports are parts of the structures in which they are located.

The applicant stated in the LRA that the AERM for carbon steel components is loss of material. In accordance with EPRI 1002950 guidelines, only general corrosion is an aging mechanism applicable to loss of material for carbon steel in air/gas or atmosphere/weather environments. The EPRI guidelines also indicate that general, crevice, and pitting corrosion and MIC are aging mechanisms applicable to loss of material for carbon steel in treated water and below-grade environments. Therefore, as the applicant stated in the LRA, management of this aging effect is required:

> The aging effect requiring management for reinforced concrete and grout components is reduction in concrete anchor capacity due to local concrete degradation. The only mechanism applicable to this aging effect is service-induced cracking or other concrete aging mechanism. Operating experience has shown that service-induced cracking can occur in concrete and grouted foundations. Concrete expansion bolts (anchors) can lose anchor capacity due to concrete or grout degradation. Therefore, management of this aging effect is required.
>
> The aging effect requiring management for elastomers (rubber, neoprene, silicone, etc.) is reduction or loss of isolation function. The aging mechanisms applicable to this aging effect are radiation hardening, temperature, humidity, and sustained vibratory loading. Operating experience has also shown that elastomer materials can degrade over time. Therefore, management of this aging effect is required.

Concerning AMPs used in addressing aging management, the applicant stated the following in the LRA:

> The System Condition Monitoring Program is used to identify and correct aging concerns for component supports in an air/gas or atmosphere/weather environment. Through general visual inspections, the System Condition Monitoring Program identifies and evaluates general corrosion of carbon steel components, service-induced cracking of grout and concrete local to support

anchorage as well as degradation due to radiation hardening, temperature, humidity, and sustained vibratory loading of vibration isolation elements.

The Structures Monitoring Program is used to identify and correct aging concerns with miscellaneous steel components in an air/gas environment. Through general visual inspections, the Structures Monitoring Program identifies and evaluates general corrosion of carbon steel components as well as service-induced cracking and degradation of grout and concrete local to the anchorage.

The Buried Piping & Tanks Inspection Program is used to identify loss of material for carbon steel conduit and the Diesel Fuel Oil Storage Tank flood tie-downs in a below-grade environment through internal inspections of buried tanks, system functional testing, and periodic inspections of buried pipe. A condition assessment evaluation is made of the buried conduit and the Diesel Fuel Oil Storage Tank flood tie-downs such that repairs can be made, if necessary, prior to loss of intended function.

Access to the components inside the torus is limited. Since the Primary Containment In-Service Inspection Program inspects components inside the torus when available, it is relied upon to manage the aging effects of the miscellaneous steel components, support members, welds, and bolted connections located inside the torus. Through general visual inspections, the Primary Containment In-Service Inspection Program identifies and evaluates general (environmental), crevice, galvanic, MIC, and pitting corrosion of carbon steel components in treated water and general corrosion in air/gas.

Finally, the applicant stated that implementation of these programs to manage aging effects/mechanisms provides added assurance that the aging effects do not occur or progress so slowly that the component's intended function will be maintained during the period of extended operation.

The staff reviewed component support/aging effect combinations not addressed by the Structures Monitoring Program and determined that other AMPs address them. The staff concluded that the applicant used the appropriate AMPs.

SER Section 3.0.3.2.23 documents the staff's evaluation of the Structures Monitoring Program. SER Section 3.0.3.3.2 documents the staff's evaluation of the System Condition Monitoring Program. SER Section 3.0.3.2.5 documents the staff's evaluation of the Buried Piping & Tanks Inspection Program. Finally, SER Section 3.0.3.1.6 documents the staff's evaluation of the Primary Containment In-Service Inspection Program.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.3.1. For those line items that apply to LRA Section 3.5.2.2.3.1, the staff determined that the applicant's AMRs are consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cumulative Fatigue Damage Due to Cyclic Loading. Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the evaluation of this TLAA.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.5.2-1 through 3.5.2-18, the staff reviewed additional details of the results of the AMRs for material, environment, AERM, and AMP combinations that are not consistent with the GALL Report, or that are not addressed in the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-18, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report and provided information concerning how it will manage the aging effect. Specifically, Note F indicates that the GALL Report does not evaluate the material for the AMR line item component. Note G indicates that the GALL Report does not evaluate the environment for the AMR line item component and material. Note H indicates that the GALL Report does not evaluate the aging effect for the AMR line item component, material, and environment combination. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that the GALL Report does not evaluate either the component or the material and environment combination for the line item.

Staff Evaluation. For component type, material, and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant demonstrated that the aging effects will be adequately managed so that intended functions will be maintained consistent with the CLB during the period of extended operation. The following sections discuss the staff's evaluation.

In LRA Tables 3.5.2-1 through 3.5.2-18, the applicant identified AMR result line items for which the aging review process identified no aging effects. The applicant stated that it identified no aging effects for components fabricated from the materials and exposed to the environments described below.

No aging effects were considered applicable to components fabricated from stainless steel material exposed to air/gas environments. On the basis of the staff's review of current industry research and operating experience, stainless steel in dry air or gas (such as nitrogen, carbon dioxide, freon, and halon) exhibits no aging effect and the SC will therefore remain capable of performing its intended functions consistent with the CLB for the period of extended operation. Based on the *Metals Handbook*, Ninth Edition, Volumes 3 and 13, stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as will be the case for the gases referenced; therefore, the staff found that stainless steel in an air/gas environment will not result in aging that will be of concern during the period of extended operation. The staff concluded that no AERMs apply for stainless steel components exposed to air or gas environments.

In RAI 3.5.2-1, dated September 28, 2005, the staff noted that the applicant listed below-grade concrete (foundation, walls) as requiring no AMP in Tables 3.5.2-2, 3.5.2-3, 3.5.2-4, 3.5.2-6, 3.5.2-7, 3.5.2-9, 3.5.2-11, 3.5.2-12, 3.5.2-13, 3.5.2-15, 3.5.2-16, and 3.5.2-17. The applicant stated that an AMP is not required to manage aging because, as described in Note 501, plant documents confirm that the concrete had an air content between 3 and 6 percent and inspections performed on concrete in accessible areas did not exhibit degradation related to freeze-thaw. The staff noted that the GALL Report recommends that concrete have a water-to-cement ratio of 0.35:0.45 to ensure no aging degradation related to freeze-thaw; therefore, the staff requested that the applicant verify the water-to-cement ratio or provide an appropriate AMP if the ratio does not meet the GALL Report recommendation. The staff raised the same question for below-grade concrete (foundations, walls, lean concrete) listed in Table 3.5.2-8.

In its response, by letter dated October 28, 2005, the applicant stated the following:

> Note: This response applies to Tables 3.5.2-2, 3.5.2-3, 3.5.2-4, 3.5.2-6, 3.5.2-7, 3.5.2-8, 3.5.2-9, 3.5.2-10, 3.5.2-11, 3.5.2-12, 3.5.2-14, 3.5.2-15, 3.5.2-16, 3.5.2-17 and 3.5.2-18 but is not applicable to Table 3.5.2-13 (i.e. not applicable since there is no below grade concrete inside drywell).
>
> The criteria used to evaluate concrete located below grade were consistent with NRC Staff final position issued for Interim Staff Guidance (ISG)-03 (see LRA Section 2.1.4.3). ISG-03 provided the following criteria for the aging effects loss of material (spalling, scaling) and cracking due to freeze-thaw for concrete in inaccessible areas (i.e. exterior locations below grade and foundations).
>
>> 'Inaccessible Areas:
>>
>> Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index>100 day-inch/yr) (NUREG-1557). Documented evidence to confirm that the in-place concrete had the air content between 3 percent to 6 percent and the subsequent inspections performed did not exhibit degradations related to freeze-thaw should be considered a part of the evaluation.'
>
> LRA Note 501 and Table 1, item 3.5.1-20, and further evaluation for 3.5.2.2.2.1 included the following statement.
>
>> 'MNGP is located in a severe weathering region according to Figure 1 of ASTM C33-90, and therefore freeze-thaw evaluation is required. Plant documents confirm that the concrete had an air content between 3 percent and 6 percent, and subsequent inspections performed on concrete in accessible areas did not exhibit degradation related to freeze-thaw. This evaluation satisfies NUREG-1801 and ISG-03 condition requirements for

concrete in inaccessible areas, and therefore loss of material and cracking due to freeze-thaw do not require aging management.'

All criteria of ISG-03 have been satisfied including an aging effect evaluation due to severe weather location, documentation confirming that the concrete had an air content between 3 percent and 6 percent, and plant inspection findings that did not exhibit degradation related to freeze-thaw.

Additionally, ISG-03 was one of five ISG guidance documents issued for implementation by the NRC prior to the LRA submittal. Under this guidance, the Staff removed the water-to-cement ratio and replaced it with the statement, 'subsequent inspections performed did not exhibit degradations related to freeze-thaw'. This substitution is consistent with ACI 318, Durability Requirements that state, 'Since it is difficult to accurately determine the water-cementitious materials ratio of concrete during production, the f'c specified should be reasonably consistent with the water-cementitious materials ratio required for durability. Selection of an f'c that is consistent with the water-cementitious ratio selected for durability will help ensure that the required water-cementitious materials ratio is actually obtained in the field.' ACI 318 also states that the quality and production of concrete must be considered. At MNGP, all in place concrete met or exceeded the design required strength (f'c). Concrete inspections continue to show no evidence of degradation due to freeze-thaw. Plant concrete design specifications (Specification for Purchase of Off-Site Concrete for the MNGP, Specification for Forming, Placing, Finishing and Curing of Concrete, and Specification for Materials Testing Services, etc.) include requirements that satisfy ACI 318 standards for materials, durability, concrete quality, mixing, and placing. Plant documents confirm that the concrete was constructed in accordance with the recommendations in ACI 201.2R for durability and therefore able to resist freeze-thaw and other age related degradation. Materials used in the concrete mix design conformed to ASTM specifications (C-94, C-150, etc.) that ensured consistent, proportional, non-porous concrete of quality materials. Aggregates conformed to the requirements of ASTM C-33 and were accepted based on ASTM C-295 (petrographic) C-289 (reactivity) and other tests. Mixing and delivering of concrete was in accordance with ACI standards for hot and cold weather conditions (ACI 305, ACI 306) and appropriate air entrainment, adequate curing, and special attention to construction practices were maintained with reference to ASTM C-260, C-494 and C-618. Utilizing industry construction standards ensured good workmanship and quality control practices (i.e., the requirements of ACI 304, 308, 309, ASTM C-94, etc.).

Compliance with the above industry code requirements and guidelines ensures that freeze-thaw is not significant as proven by the absence of freeze-thaw degradation.

The staff's review found the applicant's response to RAI 3.5.2-1 acceptable. The staff found that the applicant provided sufficient information to conclude that its below-grade concrete will not require an AMP for loss of material due to the freeze-thaw aging mechanism; therefore, the staff's concern described in RAI 3.5.2-1 is resolved.

In RAI 3.5.2-2, dated September 28, 2005, the staff noted that the applicant listed below-grade concrete (foundation, walls) as requiring no AMP in Tables 3.5.2-3, 3.5.2-4, 3.5.2-6, 3.5.2-7, 3.5.2-9, 3.5.2-11, 3.5.2-12, 3.5.2-13, 3.5.2-15, 3.5.2-16, and 3.5.2-17. The applicant stated that no AMP is required to manage aging because, as described in Note 506, (1) the plant initial licensing basis did not include a program to monitor settlement, (2) no significant settlement has been observed, and (3) de-watering systems are not used. The applicant's statement is inconsistent with ISG-03, which requires a "Structural Monitoring Program" based on the requirement of 10 CFR 50.65 (Maintenance Rule) for accessible areas and a "plant-specific program for inaccessible areas." Therefore, the staff requested that the applicant provide an appropriate AMP for this component group and below-grade concrete (foundation, walls, lean concrete) listed in Table 3.5.2-8.

In its response, by letter dated October 28, 2005, the applicant stated the following:

> Note: This response applies to Tables 3.5.2-3, 3.5.2-4, 3.5.2-6, 3.5.2-7, 3.5.2-8, 3.5.2-9, 3.5.2-10, 3.5.2-11, 3.5.2-12, 3.5.2-14, 3.5.2-15, 3.5.2-16, 3.5.2-17 and 3.5.2-18 but is not applicable to Table 3.5.2-13 (i.e. not applicable since there is no below grade concrete inside drywell).
>
> ISG-03 did not include an evaluation for the aging effects cracks, distortion, and increase in component stress level due to settlement and therefore NUREG-1801 (2001) was used to evaluate the plant specific applicability of this aging effect. Settlement is a condition that directly affects the concrete foundation components (see NUREG-1557 page B-154 and Electric Power Research Institute (EPRI) 103842 page 4-88), and thus applicable to inaccessible concrete. NUREG-1801 (2001) states that,
>
> > 'The initial Licensing Basis for some plants included a program to monitor settlement. If no settlement was evident during the first decade or so, the NRC may have given the licensee approval to discontinue the program. However, if a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.'
>
> LRA Note 506, Table 3.5.1 item number 3.5.1-25, and further evaluation 3.5.2.2.1.2 included the following statement.
>
> > 'The plant initial Licensing Basis did not include a program to monitor settlement. No significant settlement has been observed on any major structure and de-watering systems are not used. This satisfies NUREG-1801 condition requirements on concrete settlement, and therefore cracks, distortion, and increase in component stress levels due to settlement do not require aging management.'
>
> The NUREG-1801 criteria used to evaluate concrete for settlement consists of an initial Licensing Basis program to monitoring settlement, evident of settlement during the first decade, and a de-watering system relied upon for settlement control. All are not applicable to the MNGP. The initial licensing basis did not include a settlement monitoring program, no significant settlement has ever been

observed on any major structure, and de-watering systems were not used (see discussion on the Diesel Fuel Oil Transfer House that follows).

Additionally, the MNGP USAR, Section 12.2.1.11 includes a discussion on foundation design and construction. The USAR provides conclusions on foundation designs based on soil bearing values. Major building structures were constructed on bedrock, compacted granular fill, or stiff clay. No unusual or unforeseen foundation construction problems were encountered. A survey traverse of points on the buildings was established to monitor foundation settlement. This survey determined that settlement was uniform and within the predicted values. The reactor building, the turbine building and other structures are supported on mat foundations. The stack and control and cable spreading building are also on mat foundations, and the emergency diesel generator building is constructed on a continuous footing foundation. The emergency filtration train building rests on a combination of mat and caisson foundations.

The MNGP review is consistent with NUREG-1801 condition requirements for settlement, similar to the review performed in the Dresden and Quad Cities Safety Evaluation Report (SER), NUREG-1796. NUREG-1796 stated that, 'no aging management is required' and the Staff responded with, 'The Staff finds the applicant's explanation to be acceptable because there has been no requirement to monitor settlement as part of the licensing basis for all four units, and there are no de-watering systems in place.'

Although not managed for cracks, distortion, and increase in component stress level due to settlement (except for the Diesel Fuel Oil Transfer House, see below), all accessible concrete is managed for aging effects including cracks, loss of material, etc. Additionally, whenever an inaccessible area is excavated, exposed or modified, an inspection is performed.

As stated above, settlement has not been observed at any major structures. The Diesel Fuel Oil Transfer House, a small structure north of the Emergency Diesel Generator Building has experienced settlement. The structure is rectangular with external dimensions of 11'-6" (N-S) x 14' (E-W) x 13'-6" high. Walls are 1'-6" thick. It is a moderate weight structure exerting a mean bearing pressure of about 1,100 lb. / $ft.^2$ on the underlying foundation material. The foundation material is compacted granular backfill underlain by stiff clay lenses and sandstone bedrock, and should not be susceptible to settlement under the load imposed. However the Diesel Fuel Oil Transfer House has undergone significant differential settlement. Based on plant records and settlement data, settlement of the Diesel Fuel Oil Transfer House occurred rather rapidly following construction and was probably due to washout after a rainstorm and was long ago effectively complete. Settlement data recorded annually since 1992 continues to show no significant settlement of the structure. A Nonconformance Report root cause analysis concluded there was insufficient foundation support to prevent settling. Measurements taken in 1976, 1979 and 1991 show settlement has continued over the years since construction but at an extremely low rate. Surveys determined that the entire building has settled about ¾" to 1" on the east side and about 5 ¼" to 5 ½" on the west side. No evidence of cracks or distortion has been observed by the Structures Monitoring Program inspections performed in 1996 and 2002. The Diesel Fuel Oil Transfer House is monitored for the aging effects of cracks, distortion, and increase in component stress level due to settlement now on an annual basis as part of the Structures Monitoring Program and will be managed throughout the period of extended operation.

In conclusion, cracks, distortion, and increase in component stress level due to settlement is not an applicable aging mechanism for any in scope structure with the exception of the Diesel Fuel Oil Transfer House which is managed for aging effects due to settlement.

The staff's review found the applicant's response to RAI 3.5.2-2 acceptable. The applicant provided sufficient information to justify that, except for the diesel fuel oil transfer house, which is managed for aging effects due to settlement, other building structures need no management for aging effects due to settlement. The staff found the applicant's statement reasonable and acceptable regarding its management of all accessible concrete for aging effects, including cracks and loss of material, and its inspection of inaccessible areas whenever they are excavated, exposed, or modified; therefore, the staff's concern described in RAI 3.5.2-2 is resolved.

The staff's audit and review of the applicant's program found that the applicant demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.5.2.3.1 Structures and Component Supports—Cranes, Heavy Loads, Rigging—Summary of Aging Management Evaluation—Table 3.5.2-1

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the *cranes, heavy loads, and rigging component groups.*

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.2 Structures and Component Supports—Diesel Fuel Oil Transfer House—Summary of Aging Management Evaluation—Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the diesel fuel oil transfer house component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.3 Structures and Component Supports—Emergency Diesel Generator Building—Summary of Aging Management Evaluation—Table 3.5.2-3

The staff reviewed LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the EDG building component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.4 Structures and Component Supports—Emergency Filtration Train Building—Summary of Aging Management Evaluation—Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the emergency filtration train building component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.5 Structures and Component Supports—Fire Protection Barrier—Summary of Aging Management Evaluation—Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the FP barrier commodity groups.

The staff also reviewed LRA Section 3.5.2.1.5, which identified the materials, environments, AERMs, and AMPs for the FP barrier commodity group. The staff conducted its review, described below, in accordance with SRP-LR Section 3.5 and the GALL Report.

The staff's review of LRA Table 3.5.2-5 identified areas for which it needed additional information to complete its evaluation of the applicant's results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.5.2.1.5-1, dated August 18, 2005, the staff noted that LRA Table 3.5.2-5 refers to the Fire Protection Program as the AMP to manage loss of material for carbon steel in air/gas. Therefore, the staff requested that the applicant justify this conclusion.

In its response, by letter dated September 16, 2005, the applicant stated that LRA Table 3.5.2-5 refers to the Fire Protection Program as the AMP for carbon steel with a fire barrier intended function in an air/gas environment. The scope of the program described in Fire Protection Program PBD/AMP-013, Table 7.1, includes fire barriers with specific reference to carbon steel with an aging effect of loss of material in a plant indoor air environment (i.e., air/gas environment). This description is consistent with LRA Table 3.5.2-5.

The staff's review found the applicant's response to RAI 3.5.2.1.5-1 acceptable because the scope of the Fire Protection Program includes fire barriers with specific reference to carbon steel with an aging effect of loss of material in a plant indoor air environment, as described in Fire Protection Program PBD/AMP-013, Table 7.1. The staff's review of the applicant's Fire Protection Program, including Table 7.1 of PBD/AMP-013, found that it provides reasonable assurance that carbon steel components in an air/gas environment in the FP system will be managed for aging effects during the period of extended operation. Therefore, the staff's concern described in RAI 3.5.2.1.5-1 is resolved.

In RAI 3.5.2.1.5-2, dated August 18, 2005, the staff noted that LRA Tables 3.5.2-5, 3.5.2-15, and 3.5.2-17 refer to the Fire Protection Program as the AMP for fibrous fire wraps (thermal insulating wool/fiber), cementitious fireproofing (thermal insulating mastic), and rigid board (thermal insulating board) in air/gas; therefore, the staff requested that the applicant justify this conclusion.

In its response, by letter dated September 16, 2005, the applicant stated that LRA Tables 3.5.2-5, 3.5.2-15, and 3.5.2-17 refer to the Fire Protection Program as the AMP for managing aging effects for fibrous fire wraps, cementitious fireproofing, and rigid board with a fire barrier intended function in an air/gas environment. The scope of the Fire Protection Program, as described in Fire Protection Program PBD/AMP-013, Table 7.1, includes fire barriers with specific reference to fibrous fire wraps, cementitious fireproofing, and rigid board with the aging effects of cracking, delamination, and loss of material in an air/gas environment. This description is consistent with LRA Tables 3.5.2-5, 3.5.2-15, and 3.5.2-17.

The staff's review found the applicant's response to RAI 3.5.2.1.5-2 acceptable because the scope of the Fire Protection Program includes fire barriers with specific reference to fibrous fire wraps, cementitious fireproofing, and rigid board with the aging effects of cracking, delamination, and loss of material in an air/gas environment, as described in Fire Protection Program PBD/AMP-013, Table 7.1. The staff's review of the applicant's Fire Protection Program, including PBD/AMP-013, Table 7.1, found that it provides reasonable assurance that fibrous fire wraps, cementitious fireproofing, and rigid board in an air/gas environment in the FP system will be managed for aging effects during the period of extended operation. Therefore, the staff's concern described in RAI 3.5.2.1.5-2 is resolved.

The staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience determined that the applicant adequately identified applicable aging effects and the AMPs credited with managing them for the fire barrier commodity group not addressed by the GALL Report. The staff found the applicant's AMR results for the fire barrier commodity group acceptable.

3.5.2.3.6 Structures and Component Supports—Hangers and Supports—Summary of Aging Management Evaluation—Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the hangers and supports commodity groups.

The applicant proposed to manage loss of material due to MIC, pitting, and crevice corrosion of stainless steel materials for supports for ASME Code Class MC components (i.e., vent header column support pins exposed to treated water environment) using the ASME Section XI, Subsection IWF Program.

SER Section 3.0.3.2.3 documents the staff's review of the ASME Section XI, Subsection IWF Program. The ASME Section XI, Subsection IWF Program is part of the ASME Section XI In-Service Inspection Program. It provides for condition monitoring of Class 1, 2, 3, and MC component supports. The applicant will enhance it to inspect Class MC component supports consistent with the GALL Report, Chapter III, Section B1.3. The parameters monitored or inspected are loss of material and loss of mechanical function. The NDE technique used is the VT-3 method to detect unacceptable conditions such as loss of material and loss of mechanical function.

In RAI 3.5.2-3, dated September 28, 2005, the staff noted that the Table 3.5.2-6 lists below-grade concrete (diesel fuel oil storage tank deadmen) as requiring no AMP. The applicant stated that no AMP is required to manage aging because, as described in Note 552, "NUREG-1801 lists inside or outside containment as the environment. Consider that this environment includes atmosphere/weather and below grade." The applicant's statement is inconsistent with ISG-03, which requires a "Structural Monitoring Program" based on the requirement of 10 CFR 50.65 (Maintenance Rule) for accessible areas and a "plant-specific program for inaccessible areas." Therefore, the staff requested that the applicant provide an appropriate AMP for this component group.

In its response, by letter dated October 28, 2005, the applicant stated the following:

> The buried Diesel Fuel Oil Storage Tank is anchored to a concrete foundation. To account for this condition, NUREG-1801 line item III.B4.3-a, 'building concrete at locations of expansion and grouted anchors' was used. Although probably not the best usage of line III.B4.3-a, it was chosen to address this unique condition. Note 552 was provided to clarify the different environment used than that specified in NUREG-1801 (i.e., below grade rather than the NUREG-1801 environment, inside or outside containment). The LRA AMP also differed from that specified in NUREG-1801. Generic Note 'I' was used to describe these differences since it was considered the 'best' note available to describe this unique condition. The aging effect, 'reduction in concrete anchor capacity due to local degradation' for the inaccessible location was evaluated by considering all possible concrete degradation mechanisms including freeze-thaw (III.A3.1-a), leaching of calcium hydroxide (III.A3.1-b), reaction with aggregate (III.A3.1-c), corrosion of embedded steel (III.A3.1-e), aggressive chemical attack (III.A3.1-g), settlement (III.A3.1-h), and erosion of porous concrete sub-foundations (III.A3.1-h). The evaluation concluded that these mechanisms did not require aging management (see page 3-686 of the LRA). Service induced cracking was also not applicable since vibration/movement of the tank is not expected and the fact that the tank is surrounded by soil/fill material. Therefore reduction in concrete anchor capacity due to local degradation was determined insignificant and aging management not required.

The staff's review found the applicant's response to RAI 3.5.2-3 acceptable. The applicant's response stated that it had evaluated all the possible aging mechanisms/effects and concluded that they did not require an AMP. The staff found the applicant's conclusion reasonable and acceptable; therefore, the staff's concern described in RAI 3.5.2-3 is resolved.

In RAI 3.5.2-7, dated September 28, 2005, the staff noted that Table 3.5.2-6 identifies two line items related to carbon steel and low-alloy steel embedded in concrete as not requiring aging management. Note 549 states, "Requirements specified in NUREG-1801 for concrete quality, inspections, and housekeeping are satisfied for steel elements in inaccessible areas." Based on the industry-wide experience related to corrosion of the drywell shell in the sand pocket region, the staff requested that the applicant provide information regarding its inspections and housekeeping related to carbon steel and low-alloy steel embedded in concrete and explain why these activities should not be a part of an existing AMP. The embedded items are included in an existing program to look for evidence of environment change (e.g., sand drains not working properly) in accessible areas that will indicate potential degradation in inaccessible areas.

The same question applied to carbon steel and low-alloy steel embedded in concrete listed in Table 3.5.2-13.

In its response, by letter dated October 28, 2005, the applicant stated the following:

> Components in Table 3.5.2-6 refer to the embedded anchorage of the drywell support skirt, the embedded components of the female stabilizers, and embedded conduit. The evaluation of the embedded portions of the drywell shell and drywell support skirt is provided in Table 3.5.2-13.

The applicant deliberated how these components meet the following four recommendations in GALL Report line item II.B1.1.1-a:

(1) Concrete meeting the requirements of ACI 318 or 349 and the guidance of ACI 201.2R was used for the containment concrete in contact with the embedded containment shell or liner.
(2) The concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner.
(3) The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with IWE requirements.
(4) Borated water spills and water ponding on the containment concrete floor are not common and when detected are cleaned up in a timely manner.

The applicant provided the following plant-specific evaluation:

(1) Concrete meeting the following requirements was used for the containment concrete in contact with the embedded containment shell and skirt. The MNGP concrete design specifications for Purchase of Off-Site Concrete for the MNGP, Specification for Forming, Placing, Finishing and Curing of Concrete, Specification for Materials Testing Services and others specifications include requirements that satisfy ACI 318 standards for materials, durability, concrete quality, mixing and placing. Plant documents confirm that the concrete was constructed in accordance with the recommendations in ACI 201.2R for durability and therefore able to resist weathering action, chemical attack, abrasion, leaching of calcium hydroxide, corrosion of reinforcement, and chemical reactions of aggregates. Materials used in the concrete mix design conformed to ASTM specifications (C-94, C-150, etc.) that ensure consistent, proportional, non-porous concrete of quality materials. Aggregates conformed to the requirements of ASTM C-33 and were accepted based on ASTM C-295 (petrographic) C-289 (reactivity) and other tests. Mixing and delivering of concrete was in accordance with ACI standards for hot and cold weather conditions (ACI 305, ACI 306) and appropriate air entrainment, adequate curing, and special attention to

construction practices were maintained (ASTM C-260, C-494 and C-618). MNGP construction specifications ensure good workmanship and quality control practices (ACI 304, 308, 309, ASTM C-94, etc.).

(2) For accessible concrete inside drywell, the Structures Monitoring Program inspects for cracking adjacent to the moisture barrier, at the concrete floor, and RPV Pedestal. Inspections ensure that the concrete is free of penetrating cracks that provide a path for water seepage to the containment shell. The bioshield wall is completely encased in steel and therefore inaccessible for inspection.

AMPs will be used to manage the drywell to reactor building refueling seal bellows assembly located between the drywell outer shell and the reactor building concrete (See Table 3.5.2-15). By managing this assembly for aging degradation and water leakage (during refueling activities), any water seepage past the assembly to the drywell shell, sand pocket, embedded shell, and embedded skirt will be prevented, or detected and corrected. Therefore, loss of material due to corrosion for these components will be insignificant. Aging managed for the drywell to reactor building refueling seal bellows assembly will be provided by the Primary Containment In-Service Inspection Program and the Structures Monitoring Program. These Programs ensure that degradation of the assembly or any water leakage past the assembly will be detected and corrected before loss of intended function. These programs ensure that,

- the drywell air gap drain outlets and sand pocket drain outlets are not obstructed prior to refueling
- the drain lines that are incorporated into the refueling bellows assembly are monitored for leaks
- the drywell air gap drain outlets and drywell sand pocket drain outlets are inspected for signs of leakage during refueling, and
- aging effects including loss of material are detected.

The Plant Chemistry Program is also used to manage the assembly by ensuring that the water chemistry remains within design parameters.

MNGP operating history showed no evidence of refueling seal leakage, no water observed in air gap during construction, and no water used to extinguish a fire in the air gap or for any other reason. Plant engineering and maintenance personnel confirmed the absence of leakage at the drywell air gap drains, and the sand pocket drains. Plant specific operating history has proven that inspection and monitoring activities adequately manage aging effects to ensure no loss of intended function.

The applicant further asserted that the Primary Containment In-Service Inspection Program manages aging effects associated with the moisture barrier and that borated water inside the drywell is not a concern for BWR plants. With these assertions, the applicant pointed out that loss of material due to corrosion is not significant.

The staff evaluated the information provided above, and the information provided to the NRC's aging management inspection team on the status of the drywell shell, and made the following findings:

- The operating history confirmed that there is no indication of water in the air gap between the shell and the shield concrete.
- The UT measurements taken, in mid-1986 and at the end of 1987, indicate that the metal thickness in the sand pocket region varies from 1.065 inches to 1.13 inches, and the design thickness in this area of the drywell shell is 1.0 inch.
- In response to NRC GL 87-05, "Request for Additional Information Assessment of Licensee Measures to Mitigate and/or Identify Potential Degradation of Mark I Drywells," the applicant made sure that the three drain paths (i.e., the drain that would prevent potential leakages from refueling seal areas, the drains at the sand pocket areas above the sealed sand pocket area, and the drains at the bottom of the sand pocket area) are clear of any obstruction. The applicant has been monitoring these drains and plans to continue the practice during the period of extended operation.
- The entire refueling seal area is within the scope of license renewal.
- During the 1987 visual examination, some surface corrosion was noted where the concrete floor meets the inside surface of the drywell shell. This was attributed to the joint sealant used during initial construction. The sealant was removed and replaced with nonshrink grout and a new type of sealant that would prevent corrosion. The applicant will periodically examine this area as required by Subsection IWE of Section XI of the ASME Code.

Based on the above findings, the staff concluded that MNGP will adequately manage the inaccessible areas of the drywell shell during the period of extended operation, and the concern expressed in RAI 3.5.2-7 is resolved.

In RAI 3.5.2-8, dated September 28, 2005, the staff noted that recent experience with torus cracking at Fitzpatrick indicates HPC discharge configuration in the torus as a cause of cracking; therefore, the staff requested that the applicant describe its HPC configuration that could affect torus integrity during the period of extended operation.

In its response, by letter dated October 28, 2005, the applicant stated the following:

> The HPCI turbine exhaust discharge pipe configuration at MNGP is significantly different than that at Fitzpatrick.
>
> - The HPCI turbine exhaust at Fitzpatrick is located near the torus ring girder (end bay) while the MNGP HPCI turbine exhaust is located approximately mid-bay between torus ring girders
> - The Fitzpatrick HPCI exhaust pipe incorporates a 90 degree elbow, is relatively short with no holes, and discharges vertically in the vicinity of the torus ring girder and stiffener plates that are part of the torus external column support system. The Fitzpatrick torus crack was observed adjacent to these stiffener plates. The MNGP exhaust pipe is considerably longer with a submerged sparger that consist of a pipe,

capped at one end, with a large number of holes in the lower portion which increases the area available for steam condensation compared to a straight pipe discharge. The MNGP pipe is not a vertical run, but instead, incorporates a 60 degree elbow.

Based on the above comparison, the HPCI Turbine Exhaust configuration and location at MNGP is unlike that at Fitzpatrick. The MNGP pipe configuration and location are believed to be less susceptible to cracking and therefore less likely to affect torus integrity during the period of extended operation.

The staff's review found the applicant's response to RAI 3.5.2-8 acceptable. Based on the review of the root cause analysis of the through-wall crack at Fitzpatrick, the configuration of HPC steam discharge (using spargers), and the location of HPC exhaust pipe, the staff found the applicant's torus is not prone to such cracking. Therefore, the staff's concern described in RAI 3.5.2-8 is resolved.

In RAI 3.5.2-9, dated September 28, 2005, the staff noted that three line items in Table 3.5.2-6 indicate that lubrite plates have been used at several locations in hangers and supports. The staff's position is that an inspection of the accessible portion of the lubrite bearing is needed to ensure proper functioning during postulated environmental conditions; therefore, the staff requested that the applicant incorporate an examination of the accessible portion of the lubrite bearings in an appropriate AMP.

In its response, by letter dated October 28, 2005, the applicant stated the following:

> Industry guidance provided in EPRI-1002950, Aging Effects for Structures and Structural Components, Revision 1 dated August 2003 for lubrite or similar material states that, 'An extensive search of industry operating experience did not identify any instances of lubrite plate degradation or failure to perform its intended function.' Additionally EPRI states that, 'Lubrite material resists deformation, has a low coefficient of friction, resists softening at elevated temperatures, absorbs grit and abrasive particles, is not susceptible to corrosion, withstands high intensities of radiation, and will not score or mar. Lubrite products are solid, permanent, completely self lubricating, and require no maintenance for the design life of the product. The lubrite lubricants used in nuclear applications are designed specifically for the environments to which they are exposed.'
>
> Review of the MNGP pipe support and MC component support drawings where Lubrite or similar material was used reveals that the sliding surfaces are sandwiched between plates, and therefore, inaccessible for inspection. Plant specific operating experience found no evidence of age-related degradation for Lubrite or similar material during support overhaul activities, and no pipe or pipe support failures attributed to the inability of sliding surface material to function as designed.

However, the applicant stated that aging effects for lubrite or similar materials are not significant, and although no aging management is required, the ASME Section XI, Subsection

IWF Program inspects the supports in LRA Table 3.5.2-6 incorporating the use of lubrite or similar materials.

The staff's review found the applicant's response to RAI 3.5.2-9 acceptable. The staff recognized the operating experience with the use of lubrite bearings and found the applicant's approach to inspect them under its ASME Section XI, Subsection IWF program acceptable. Therefore, the staff's concern described in RAI 3.5.2-9 is resolved.

On the basis of its review of the applicant's programs, aging effects, and plant-specific and industry operating experience, the staff determined that the ASME Section XI, Subsection IWF Program effectively manages the loss of material due to MIC, pitting, and crevice corrosion of stainless steel materials for supports for ASME Code Class MC components (i.e., vent header column support pins exposed to treated water environment), as given in LRA Table 3.5.2-6.

3.5.2.3.7 Structures and Component Supports—HPC Building—Summary of Aging Management Evaluation—Table 3.5.2-7

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the HPC building component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.8 Structures and Component Supports—Intake Structure—Summary of Aging Management Evaluation—Table 3.5.2-8

The staff reviewed LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the intake structure component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.9 Structures and Component Supports—Miscellaneous Station Blackout Yard Structures—Summary of Aging Management Evaluation—Table 3.5.2-9

The staff reviewed LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the miscellaneous SBO yard structures component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.10 Structures and Component Supports—Offgas Stack—Summary of Aging Management Evaluation—Table 3.5.2-10

The staff reviewed LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the offgas stack component groups.

In RAI 3.5.2-4, dated September 28, 2005, the staff noted that Table 3.5.2-10 lists below-grade concrete (Pedestal) as requiring no AMP. The applicant stated that no AMP is required to manage aging because, as described in Notes 501 and 506, (1) the plant initial licensing basis did not include a program to monitor settlement, (2) no significant settlement has been observed, (3) de-watering systems are not used, and (4) plant documents confirm that the concrete had an air content between 3 and 6 percent and inspection of concrete in accessible areas found no degradation related to freeze-thaw. The GALL Report recommends that concrete should have a water-to-cement ratio of 0.35-0.45 to ensure no aging degradation related to freeze-thaw; therefore, the staff requested that the applicant verify the water-to-cement ratio as 0.35-0.45. The staff noted that the applicant's statement is inconsistent with ISG-03, which requires a "Structural Monitoring Program" based on the requirement of 10 CFR 50.65 (Maintenance Rule) for accessible areas and a "plant-specific program for inaccessible areas." The staff raised the same question for below-grade concrete (foundation, walls, slabs, grout) listed in Table 3.5.2-18.

In its response, by letter dated October 28, 2005, the applicant stated that the responses to RAIs 3.5.2-1 and 3.5.2-2 are applicable to this question. The staff's review found the applicant's response to RAI 3.5.2-4 acceptable. The staff's evaluation of these responses is described in SER Section 3.5.2.3. Therefore, the staff's concern described in RAI 3.5.2-4 is resolved.

3.5.2.3.11 Structures and Component Supports—Offgas Storage and Compressor Building—Summary of Aging Management Evaluation—Table 3.5.2-11

The staff reviewed LRA Table 3.5.2-11, which summarizes the results of AMR evaluations for the offgas storage and compressor building component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.12 Structures and Component Supports—Plant Control and Cable Spreading Structure—Summary of Aging Management Evaluation—Table 3.5.2-12

The staff reviewed LRA Table 3.5.2-12, which summarizes the results of AMR evaluations for the plant control and cable spreading structure component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.13 Structures and Component Supports—Primary Containment—Summary of Aging Management Evaluation—Table 3.5.2-13

The staff reviewed LRA Table 3.5.2-13, which summarizes the results of AMR evaluations for the primary containment component groups.

The applicant proposed to manage loss of material due to MIC, pitting, and crevice corrosion of stainless steel materials for thermowells exposed to a treated water environment using the Plant Chemistry, Primary Containment In-Service Inspection, and 10 CFR Part 50, Appendix J Programs.

The SER documents the staff's reviews and evaluations of the Plant Chemistry Program, the Primary Containment In-Service Inspection Program, and the 10 CFR 50, Appendix J Program in Sections 3.0.3.2.19, 3.0.3.1.6, and 3.0.3.2.1, respectively.

Pitting of stainless steel components relates primarily to the presence of detrimental ionic species like chlorides, fluorides, and sulfates. Crevice corrosion of stainless steel components relates primarily to the presence of significant levels of dissolved oxygen. The Plant Chemistry Program manages these aging effects by ensuring that corrosive ion concentrations do not exceed acceptance limits and that pH remains within an acceptable range. In addition, this program controls the growth of organic substances, thus eliminating MIC.

The Primary Containment In-Service Inspection Program specifies visual examination of accessible surfaces on the containment pressure-retaining boundary, internal vent system, and steel components within the torus to detect indications of damage or deterioration that could adversely affect the intended functions of the containment system.

The 10 CFR 50, Appendix J Program specifies pneumatic pressure tests and visual examinations to verify the structural and leak integrity of the primary containment.

In RAI 3.5.2-5, dated September 28, 2005, the staff noted that, in describing the intended functions of the three items in Table 3.5.2-13 related to concrete in air/gas, the applicant stated that one of the intended functions is "non-safety support." Therefore, the staff requested that the applicant clarify this characterization in terms of the CLB safety classification as well as in terms of the criteria in 10 CFR 54.4, "Scope," and provide examples of how the components provide nonsafety support.

In its response, by letter dated October 28, 2005, the applicant explained:

> The primary containment in scope concrete components subject to an AMR with the intended function, 'non-safety support' were identified in Table 2.4.13-1 with AMR results provided in Table 3.5.2-13. Table 2.1-1 of the LRA included the definition as,
>
> > 'Provide structural support to non-safety related components whose failure could prevent satisfactory accomplishment of any of the required safety related functions.'
>
> This component-level intended function was the specific function of the component that supported system-level functions that formed the basis for including the primary containment structure within the scope of license renewal. The scoping methodology utilized by the NMC for the MNGP was consistent with the guidance provided by the NRC in NUREG-1800 and by the industry in Nuclear Energy Institute (NEI) 95-10.
>
> In terms of the MNGP CLB, this function was characterized in a license renewal technical report as,
>
> > 'The MNGP CLB includes a number of topics that identify NSR SSCs credited for preventive or mitigative functions in support of safe shutdown for

special events (e.g., external floods) or whose failure could prevent satisfactory accomplishment of a Scoping Criterion 1 function (e.g., Seismic II/I considerations). Based on a review of the CLB, those topics that meet Scoping Criterion 2 are, High Energy Line Break (HELB)...Flooding Events...Missile Hazards...Overhead Handling Systems...Seismic Interaction.'

In terms of 10 CFR 54.4, this function was characterized in a technical report for license renewal as,

'[Non-safety related] NSR SSCs directly connected to Scoping Criterion 1 SSCs: The in-scope boundary for license renewal extends into the NSR portion of the piping and supports up to and including the first equivalent anchor beyond the safety/nonsafety interface. For Monticello, the first equivalent anchor is that point beyond which failure of the piping system will not prevent the satisfactory accomplishment of the Scoping Criterion 1 function of the connected SSCs.

NSR structures attached to, or next to, Scoping Criterion 1 structures are in scope for license renewal if their failure could prevent a Scoping Criterion 1 SSC from performing its intended function.

NSR SSCs that are not directly connected to Scoping Criterion 1 SSCs: The NSR SSCs may be in-scope if their failure could prevent the performance of a Scoping Criterion 1 function.'

The license renewal technical report included further discussion on NSR SSCs that are not directly connected to Scoping Criterion 1 SSCs with detailed information on the identification process of spatial interactions, a process to determine which NSR conduits, trays, junction boxes, and lighting fixtures to consider in scope for license renewal, and the process for determining in scope NSR HVAC ducts and supports.

An example of how concrete components provide nonsafety support would be an attachment to the concrete of NSR light fixtures or NSR HVAC duct routed near/above scoping Criteria 1 components.

The staff's review found the applicant's response to RAI 3.5.2-5 acceptable. The applicant described the scoping process for NSR components (including the components that function as supports). This description is sufficient to explain the nonsafety characterization of the components, and the staff found the scoping process used in this context acceptable. Therefore, the staff's concern described in RAI 3.5.2-5 is resolved.

In RAI 3.5.2-6, dated September 28, 2005, the staff noted that Table 3.5.2-13 lists several structural components (e.g., drywell equipment foundation, bioshield wall, RPV pedestal) under the component type concrete in air/gas. LRA Section 3.5.2.2.1.3 and Note 508 describe and justify the elevated temperatures around the reactor vessel based on the estimated temperatures in the drywell; therefore, the staff requested that the applicant provide (1) a summary description of the cooling system installed to control the temperatures inside the drywell and (2) the operating experience related to the effectiveness of the cooling system. Relevant to this request, the staff inquired whether the shield wall temperatures or any other parameter monitored will detect malfunctioning of the cooling system.

Furthermore, following the discussion of the elevated temperatures in and around the bioshield wall in LRA Section 3.5.2.2.1.3, the staff agreed that the concrete properties will not be affected significantly if the actual temperatures around the shield wall remain within the estimated limits; however, additional shrinkage and loss of moisture due to radiation could degrade the concrete in the long term. In this context the staff requested that the applicant summarize the results of the last two inspections performed for (1) the bioshield wall, (2) RPV pedestal, (3) anchorages of seismic stabilizer frame, and (4) masonry walls (if any) inside the drywell.

In its response, by letter dated October 28, 2005, the applicant provided the following discussion:

a) Drywell fan coolers are used to control temperatures inside the drywell. USAR Section 5.2 states that, 'The primary containment ventilating and cooling system consists of four air coolers which cool the atmosphere to below a 135 °F bulk average drywell temperature during normal plant operation. The drywell atmosphere is circulated through the drywell and the air coolers by fans, and the reactor building closed cooling water system is employed to remove heat from the air coolers.'

b) Plant daily operating data confirms that the general area maximum normal operating temperature inside drywell is below the NUREG-1801 limit of 150 °F. Therefore the drywell fan coolers have proven their effectiveness in controlling the drywell air temperature. Plant calculations determined that the biological shield wall pipe penetrations were sufficiently designed in size, insulation characteristics, and air gap to limit the local area maximum normal operating temperatures to 179 °F, less than the NUREG-1801 threshold local area temperature of 200 °F.

c) Results of the 1996, 1998 and 2002 Periodic Structural Inspection Reports found all concrete at the RPV Pedestal to be acceptable with no deficiencies observed. The bioshield wall is complete encased in steel and therefore cannot be inspected. Drywell structural steel components were found acceptable with no deficiencies observed including stabilizer attachment welds to the plated bioshield wall. USAR Section 12 states that the primary function of the bioshield wall is, 'to protect equipment inside the drywell against radiation and thermal effects. The structure is capable of transmitting loads due to seismic and jet forces acting on it. The biological shield is composed of two steel cylinders interconnected with 27 WF (177 lb/ft) columns and is filled with concrete. Because of the radiation and temperature effects on the concrete only the lower 12 feet of concrete, up to the 959 foot elevation, has been designed as structural concrete capable of resisting forces and shears. Above the 959 foot elevation the two steel cylinders and 27 WF columns are structurally adequate and the concrete fill has not been considered as adding to the support.'

The staff's review found the applicant's response to RAI 3.5.2-6 acceptable. The response adequately describes the temperatures in the drywell and the effectiveness of the cooling system in keeping temperatures within the threshold limits. The response also describes the condition of the vital concrete and structural components in the drywell. The staff found the applicant's method of cooling the drywell atmosphere and monitoring the structural components in the drywell acceptable; therefore, the staff's concern described in RAI 3.5.2-6 is resolved.

In RAI 3.5.2-10, dated September 28, 2005, the staff noted that a recent breakage of T-quencher support bolts at the Edwin I. Hatch plant indicated that the Plant Chemistry Program that controls the chemistry of treated water may not be adequate for managing the aging of submerged support components; therefore, the staff requested that the applicant address the adequacy of the Plant Chemistry Program alone to manage the aging degradation of the submerged supports. The staff further noted that this RAI applies to all line items in Table 3.5.2-13 identifying the Plant Chemistry Program as the sole AMP.

In its response, by letter dated October 28, 2005, the applicant confirmed the following:

> All line items in Table 3.5.2-13 in a treated water environment (submerged) are managed by the Plant Chemistry Program, in addition to the MNGP Primary Containment In-Service Inspection Program, and in many cases, are also managed by a third program, 10 CFR 50, Appendix J. Therefore, the applicant asserted this RAI is not applicable to MNGP.
>
> Additionally, the MNGP Primary Containment In-Service Inspection Program includes activities that perform periodic visual inspections by divers (when the torus is not drained) and by engineers (when drained) for submerged components, including their support members, bolted connections, and welds. Components inspected include such items as T-quenchers, SRV piping and supports, ECCS strainers, vent header supports, catwalk supports, and other submerged piping and supports not included in the IWE, VT-3 inspection. Inspections are conducted periodically at intervals not to exceed five (5) years. The MNGP Primary Containment In-Service Inspection Program manages aging effects for visible degradation such as deformation, cracks, corrosion, loose bolts, etc.

The staff's review found the applicant's response to RAI 3.5.2-10 acceptable. The response indicates that the applicant plans to use the Primary Containment In-Service Inspection Program and the 10 CFR Part 50, Appendix J Program, as appropriate, for managing aging of components in these line items. The staff found the applicant's approach to managing the aging of these components acceptable; therefore, the staff's concern described in RAI 3.5.2-10 is resolved.

In RAI 3.5.2-11, dated September 28, 2005, the staff noted that for a number of items in Table 3.5.2-13, the applicant identified the 10 CFR Part 50, Appendix J Program as the AMP to manage aging. Option B of Appendix J will permit the applicant to conduct Type B leakage rate tests of penetrations at 10-year intervals; therefore, the staff requested that the applicant address the plant-specific process (e.g., test frequency and operating experience) credited with managing degradation and leak tightness of the pressure boundary penetrations, including vent bellows.

In its response, by letter dated October 28, 2005, the applicant stated the following:

> Type B tests, which are conducted at performance-based intervals not exceeding 120 months (plus an extension of 15 months if required by the refueling schedule), are performed to assess leakage through individual penetration isolation barriers other than valves. Pursuant to NEI 94-01, air lock tests must be performed at intervals not exceeding 30 months and at other times as determined by air lock use. Also, bolted access-way cover seals are always tested following end-of-outage closures of the access-ways. The default interval between Type B tests is 30 months. The interval may be extended to 60 months following two (2) consecutive tests with results that meet performance leakage acceptance criteria and to 120 months following three (3) consecutive tests that meet these criteria. The interval reverts to the default interval following a test failure.
>
> The MNGP operating history on bellow leakage/replacement is limited to one, 2-ply bellow. Leakage was identified during LLRT and not a result of cracks observed during a visual examination. Leakage was identified at the outer-most bellows from a small failure underneath the outer collar of the expansion joint and consequently the bellow was replaced. No cracks in the weld metal were identified. Industry operating history has also identified cracked bellows, but no cracks in the weld metal.

The staff's review found the applicant's response to RAI 3.5.2-11 acceptable. The operating history of the penetrations and vent bellows demonstrates that the applicant applies CLB requirements for leak-rate testing of these pressure-retaining components; therefore, the staff found the approach used by the applicant in ensuring the leak tightness of these components acceptable, and the staff's concern described in RAI 3.5.2-11 is resolved.

In RAI 3.5.2-12, dated September 28, 2005, the staff noted that three line items in Table 3.5.2-13 indicate that lubrite plates had been used at several locations in the primary containment. In Note 556, the applicant stated that graphite plate material is not used for drywell head and downcomers; therefore, the staff requested that the applicant clarify how lubrite plates were used for drywell head and downcomers. In Note 559, the applicant stated that beam seats in the drywell consist of carbon steel plate over a bronze plate lubricated with graphite packed into trepanned depressions. The steel plate covers the graphite packing and protects it from particulate contaminants. The staff believes that if the lubrite bearing is qualified generally for use in the sustained temperatures and radiation existing in the drywell, the accessible part of the bearing should be inspected to ensure proper functioning during postulated environmental conditions. The staff requested the applicant to incorporate an examination of the accessible portion of the lubrite bearings in an appropriate AMP.

In its response, by letter dated October 28, 2005, the applicant stated the following:

> Lubrite type material is not used for the drywell head or downcomers. Table 3.5.2-13 line entry was necessary to demonstrate that aging effects in NUREG-1801 line item II.B1.1.1-e were evaluated. The evaluation provided in Table 3.5.2-13, note 556 stated that, 'The drywell head and downcomer pipes

are carbon steel material. Graphite plate material is not used for these components and therefore the aging effect is not applicable.'

NUREG-1801 line item II.B1.1.1-e also includes fretting due to mechanical wear of carbon steel. EPRI-1002950, Structural Tools, evaluated fretting as loss of material occurring as a result of the relative motion between two components. EPRI concluded that thermal cycling during plant heat-up, cool down (refueling operations) and normal operation have insufficient relative motion and frequency to result in significant wear. EPRI concluded that wear of carbon steel is a design issue that incorporates sliding surfaces into the design. In accordance with the EPRI evaluation, the drywell head and downcomers do not require aging management for fretting. Note that the drywell head and downcomers are managed for loss of material due to corrosion consistent with NUREG-1801 line II.B1.1.1-a. See Table 3.5.2-13 for this evaluation.

On the subject of lubrite plates, the applicant explained the following:

Lubrite material incorporated into radial beam seat connections is used inside drywell to connect platform steel to the drywell shell. The beam seat Lubrite plate is sandwiched between larger steel plates which overhang it, and therefore, inspection is not possible. These beam seats are well over 20 feet from the reactor pressure vessel and outside the bioshield wall. This is the only application of Lubrite type material in use inside the drywell where the higher gamma radiation levels are expected. According to EPRI-1002950 the only aging effect for Lubrite is change in material properties, and only if Lubrite is exposed to at least 10^4 Rads. Radiation levels outside the bioshield wall at the perimeter of the drywell would be significantly less that the EPRI threshold limit. All other Lubrite type material applications are outside the drywell where radiation levels would typically be significantly less than inside the drywell.

The staff's review found the applicant's response to RAI 3.5.1-12 acceptable. The applicant clarified its intention and approach in managing the line item components. The staff found the applicant's aging management of lubrite materials acceptable; therefore, the staff's concern described in RAI 3.5.2-12 is resolved.

The staff's review of the applicant's programs, the aging effects, and plant-specific and industry operating experience determined that the Plant Chemistry Program, the Primary Containment In-Service Inspection Program, and the 10 CFR Part 50, Appendix J Program effectively manage the aging effect of loss of material due to MIC, pitting, and crevice corrosion of stainless steel material exposed to a treated water environment. On this basis, the staff found the applicant's management of loss of material due to MIC, pitting, and crevice corrosion in primary containment acceptable.

3.5.2.3.14 Structures and Component Supports—Radioactive Waste Building—Summary of Aging Management Evaluation—Table 3.5.2-14

The staff reviewed LRA Table 3.5.2-14, which summarizes the results of AMR evaluations for the radioactive waste building component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.15 Structures and Component Supports—Reactor Building—Summary of Aging Management Evaluation—Table 3.5.2-15

The staff reviewed LRA Table 3.5.2-15, which summarizes the results of AMR evaluations for the reactor building component groups.

The staff also reviewed LRA Section 3.5.2.1.15, which identifies the materials, environments, AERMs, and AMPs for the reactor building component group. The staff conducted its review, described below, in accordance with SRP-LR Section 3.5 and the GALL Report.

The applicant has proposed to manage the reduction of neutron absorbing capacity and loss of material due to corrosion of boral with the Plant Chemistry Program in conjunction with a one-time inspection.

The applicant stated that the Plant Chemistry Program manages the aging effects of boral in a treated water environment due to crevice, galvanic, and pitting corrosion and MIC, and the aging effect of cracking due to SCC, by ensuring that corrosive ion concentrations do not exceed acceptable limits and by limiting the amount of impurities in the water. The applicant further stated that plant test results and industry experience indicate that use of the Plant Chemistry Program during the period of extended operation will continue to manage the loss of neutron absorption capacity aging effect effectively. The applicant will apply the One-Time Inspection Program for added assurance that aging effects do not occur.

The staff's review of LRA Table 3.5.2-15 and LRA Section 3.5.2.1.15 identified areas in which the staff needed additional information to complete its evaluation of the applicant's results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.5.2.1.15-1, dated August 18, 2005, the staff requested that the applicant provide details of the plant's Boral Coupon Surveillance Program.

In its response, by letter dated September 16, 2005, the applicant stated the following:

> ...The program placed seven sets of coupons in the fuel pool to be removed on a periodic basis and tested for degradation. To date, six of the seven coupon sets have been removed and tested and no degradation has been found (see response to RAI 3.5.2.1.15-3 for test results). Testing methods include physical observations; neutron attenuation tests; weight, specific gravity, dimensional checks; and analysis for boron content. The final (seventh) coupon set will be removed and tested before the period of extended operation to satisfy the requirement for a one-time inspection. No further testing is proposed during the period of extended operation pending acceptable results from the final inspection.

The applicant based its election not to continue coupon testing into the period of extended operation partly on the results of the six previously tested coupons, which represent over 20 years of operating experience.

In response to staff RAI 3.5.2.1.15-3, dated September 16, 2005, the applicant provided test results for the past coupon inspections indicating that all coupons have retained the required level of neutron absorption capability with no discernable degradation.

The staff needed additional information to complete its evaluation for the aging management of boral. The applicant will not test boral coupons into the period of extended operation. For this reason, the staff requested that the applicant provide details on its ability to identify a potential aging effect in the plant's boral. Because the applicant will not test actual boral samples, it must provide assurance that it will be able to identify and mitigate any degradation of boral over the period of extended operation.

In a supplemental response, dated November 17, 2005, the applicant stated that it will remove the unclad coupon in the final (seventh) coupon set from the pool and visually examine it before the period of extended operation to satisfy the requirement for a one-time inspection. The applicant will return the unclad coupon to the spent fuel pool immediately following the visual examination, and the entire set of coupons will remain in the spent fuel pool until they are removed for surveillance testing sometime during the period of extended operation.

The applicant's operating experience indicates that it is unlikely that the final boral coupon set will exhibit degradation if tested before the period of extended operation. The applicant maintains that the final coupon set will provide greater assurance of boral performance if it is tested during the period of extended operation. The applicant's visual inspection of the unclad coupon will satisfy the requirement for a one-time inspection and will provide additional assurance that the boral has not experienced significant degradation since the examination of the last coupon set.

The staff found the applicant's response to RAI 3.5.2.1.15-3 acceptable based on the conduct of a one-time inspection of the remaining coupon to determine if there is any unacceptable degradation of the neutron absorption capability. Therefore, the staff's concern described in RAI 3.5.2.1.15-3 is resolved.

In RAI 3.5.2.1.5-3, dated August 18, 2005, the staff noted that LRA Tables 3.5.2-15 and 3.5.2-17 refer to the Structures Monitoring Program as the AMP to manage aging effects for rigid board (thermal insulating board) in an air/gas environment; therefore, the staff requested that the applicant justify this conclusion.

In its response, by letter, dated September 16, 2005, the applicant stated the following:

> LRA Tables 3.5.2-15 and 3.5.2-17 refer to the Structures Monitoring Program as the AMP for managing the aging effects for gypsum board walls (rigid board) with fire barrier and HELB barrier intended functions in an air/gas environment. The scope of the Structures Monitoring Program described in the Structures Monitoring Program PBD/AMP-027, Table 7.1 includes rigid board with the aging effect loss of material in an air/gas environment. This is consistent with LRA Tables 3.5.2-15 and 3.5.2-17.
>
> Since gypsum board walls perform fire barrier and HELB intended functions, both the Structures Monitoring Program and the Fire Protection Program will

manage the aging effects, ensuring the intended functions will be maintained consistent with the CLB for the period of extended operation.

The staff's review found the applicant's response to RAI 3.5.2.1.5-3 acceptable because the scope of the Fire Protection Program in PBD/AMP-013, Table 7.1, includes gypsum board walls (rigid board) with fire barrier and HELB barrier intended functions in an air/gas environment. The staff's review of the applicant's Fire Protection Program, including PBD/AMP-013, Table 7.1, found that components of the FP system will be managed for aging effects during the period of extended operation. The applicant also stated that both the Structures Monitoring Program and the Fire Protection Program will manage the aging effect of gypsum board walls; therefore, the staff's concern described in RAI 3.5.2.1.5-3 is resolved.

The staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience determined that the applicant adequately identified applicable aging effects and the AMPs credited with managing them for the reactor building component group not addressed by the GALL Report. The staff found the applicant's AMR results for the reactor building component group acceptable.

3.5.2.3.16 Structures and Component Supports—Structures Affecting Safety—Summary of Aging Management Evaluation—Table 3.5.2-16

The staff reviewed LRA Table 3.5.2-16, which summarizes the results of AMR evaluations for the structures affecting safety component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

3.5.2.3.17 Structures and Component Supports—Turbine Building—Summary of Aging Management Evaluation—Table 3.5.2-17

The staff reviewed LRA Table 3.5.2-17, which summarizes the results of AMR evaluations for the turbine building component groups.

The staff also reviewed LRA Section 3.5.2.1.17, which identifies the materials, environments, AERMs, and AMPs for the turbine building component group. The staff conducted its review, described below, in accordance with SRP-LR Section 3.5 and the GALL Report.

As discussed in the resolution to RAI 3.5.2.1.5-3, the staff found that the Structures Monitoring Program will properly manage the aging effects for gypsum board walls (rigid board) in an air/gas environment.

The staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience determined that the applicant adequately identified applicable aging effects and the AMPs credited with managing them for the turbine building component group not addressed by the GALL Report. The staff found the applicant's AMR results for the turbine building component group acceptable.

3.5.2.3.18 Structures and Component Supports—Underground Duct Bank—Summary of Aging Management Evaluation—Table 3.5.2-18

The staff reviewed LRA Table 3.5.2-18, which summarizes the results of AMR evaluations for the underground duct bank component groups.

All line items in this table are consistent with the GALL Report or are included in the discussion in Section 3.5.2.3 above.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the containments, structures, and component supports system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concluded that they adequately describe the AMPs credited with managing aging of the containments, structures, and component supports, as required by 10 CFR 54.21(d).

3.6 Aging Management of Electrical and Instrumentation and Controls

This section of the SER documents the staff's review of the applicant's AMR results for the electrical and instrumentation and controls (I&C) components associated with the following:

- electrical penetrations commodity group
- fuse holders commodity group
- non-environmental qualification (EQ) cables and connections commodity group
- offsite power/SBO recovery path commodity group

3.6.1 Summary of Technical Information in the Application

In LRA Section 3.6, the applicant provided AMR results for the electrical and I&C components. In LRA Table 3.6.1, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the electrical and I&C components.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a

review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In addition, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs are consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs. SER Section 3.0.3 documents the staff's evaluations of the AMPs. The MNGP audit and review report details the staff's audit evaluation, summarized in SER Section 3.6.2.1.

The staff also performed an onsite audit of those selected AMRs that are consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the acceptance criteria in SRP-LR Section 3.6.2.2. The MNGP audit and review report documents the staff's audit evaluations, summarized in SER Section 3.6.2.2.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that are not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether the applicant identified all plausible aging effects and whether the aging effects listed are appropriate for the combination of materials and environments specified. The MNGP audit and review report documents the staff's audit evaluations. SER Section 3.6.2.3 summarizes the staff's audit evaluations and documents the staff's technical review.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the electrical and I&C components.

Table 3.6-1 below summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.6 that are addressed in the GALL Report.

Table 3.6-1 Staff Evaluation for Electrical and Instrumentation and Controls Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements (Item Number 3.6.1-01)	Degradation due to various aging mechanisms	Environmental qualification of electric components	TLAA	This TLAA is evaluated in Section 4.7, Environmental Qualification of Electrical Equipment (EQ)
Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements (Item Number 3.6.1-02)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/ thermoxidative degradation of organics; radiolysis and photolysis [ultraviolet (UV) sensitive materials only] of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B2.1.15)	Consistent with GALL Report, which recommends no further evaluation
Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (IR) (Item Number 3.6.1-03)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/ thermoxidative degradation of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements	Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B2.1.16)	Consistent with GALL Report, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Inaccessible medium-voltage (2 kV to 15 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements (Item Number 3.6.1-04)	Formation of water trees, localized damage leading to electrical failure (breakdown of insulation), water tress caused by moisture intrusion	Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program (B2.1.21)	Consistent with GALL Report, which recommends no further evaluation
Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage (Item Number 3.6.1-05)	Corrosion of connector contact surfaces caused by intrusion of borated water	Boric acid corrosion		Not applicable, PWR only

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in SER Section 3.6.2.1, involves the staff's review of the AMR results for electrical and I&C components that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in SER Section 3.6.2.2, involves the staff's review of the AMR results for electrical and I&C components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.6.2.3, involves the staff's review of the AMR results for electrical and I&C components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. SER Section 3.0.3 documents the staff's review of AMPs that are credited to manage or monitor aging effects of the electrical and I&C components.

3.6.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.6.2.1, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the electrical and I&C components:

- Bus Duct Inspection Program (B2.1.6)
- Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B2.1.15)
- Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B2.1.16)
- Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program (B2.1.21)

Staff Evaluation. In LRA Tables 3.6.2-1 through 3.6.2-4, the applicant summarized the AMRs for the electrical and I&C components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the GALL Report evaluation bounds the plant-specific components contained in these GALL Report component groups.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component applies to the component under review. The staff verified whether it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but the applicant credited a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP will manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA is applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant (1) provided a brief description of the system, components, materials, and environment; (2) stated that the GALL Report reviewed the applicable aging effects, and (3) identified those aging effects for the electrical and I&C components that are subject to an AMR. On the basis of its audit and review the staff determined that, for AMRs not requiring further evaluation, as identified in LRA Table 3.6.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. The staff's review concluded that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff concluded that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application. In LRA Section 3.6.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the electrical and I&C components. The applicant provided information concerning how it will manage the aging effects in electrical equipment subject to EQ.

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addresses the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.6.2.2. The staff's audit and review report details the staff's audit. The following sections discuss the staff's evaluation of the aging effects.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

In LRA Section 3.6.2.2.1, the applicant stated that EQ is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.7 documents the staff's review of the applicant's evaluation of this TLAA.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.6.2-1 through 3.6.2-4, the staff reviewed additional details of the results of the AMRs for material, environment, AERM, and AMP combinations that are not consistent with the GALL Report, or that are not addressed in the GALL Report.

In LRA Tables 3.6.2-1 through 3.6.2-4, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report and provided information concerning how it will manage the aging effect. Specifically, Note F indicates that the GALL Report does not evaluate the material for the AMR line item component. Note G indicates that the GALL Report does not evaluate the environment for the AMR line item component and material. Note H indicates that the GALL Report does not evaluate the aging effect for the AMR line item component, material, and environment combination. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that the GALL Report does not evaluate either the component or the material and environment combination for the line item.

Staff Evaluation. For component type, material, and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation. The following sections discuss the staff's evaluation.

In LRA Tables 3.6.2-1 through 3.6.2-4, the applicant identified AMR line items for which the aging review process identified no aging effects. The applicant stated that it identified no aging effects for components fabricated from the materials and exposed to the environments described below.

3.6.2.3.1 Electrical Components—Electrical Penetrations Commodity Group—Summary of Aging Management Evaluation—Table 3.6.2-1

The staff reviewed LRA Table 3.6.2-1, which summarizes the results of AMR evaluations for the electrical penetrations commodity group component groups.

In LRA Table 3.6.2-1, the applicant stated that no aging effects occur when components fabricated from epoxy, fiberglass, and hypalon paint material are exposed to heat, radiation, and moisture environment. The applicant further stated that GE supplied the non-EQ penetrations and that they are manufactured and tested to the same specifications as the GE-supplied EQ penetrations.

The materials subject to aging that are installed in the penetrations are epoxy, fiberglass, and hypalon paint. The applicant evaluated these materials as part of the EQ calculation associated with GE penetrations. Fiberglass is a spun glass inert material not susceptible to significant thermal degradation. Of the two organic materials, epoxy and hypalon paint, epoxy is considered more susceptible to radiation effects. In accordance with the applicant's EQ calculation, the lifetime of these two materials exceeds the required 60-year service life. Because the evaluated temperature and radiation levels of the organic materials exceed those to which the materials are actually exposed (service conditions for the drywell are 135 °F and 1.58×10^7 Rads), the materials are shown to have an expected lifetime in excess of 60 years. When a component's expected lifetime exceeds its intended service life, there are no aging effects which require management because the component remains capable of performing its intended function; therefore, no aging effects are considered applicable to components fabricated from epoxy, fiberglass, and hypalon paint material exposed to heat, radiation, and moisture environments.

The staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience determined that heat, radiation, or moisture on epoxy, fiberglass, and hypalon paint will not result in aging that will be of concern during the period of extended operation. Therefore, the staff concluded that epoxy, fiberglass, and hypalon paint components exposed to a heat, radiation, and moisture environment have no applicable AERMs and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3.2 Electrical Components—Fuse Holders Commodity Group—Summary of Aging Management Evaluation—Table 3.6.2-2

The staff reviewed LRA Table 3.6.2-2, which summarizes the results of AMR evaluations for the fuse holders commodity group component groups.

In LRA Table 3.6.2-2, the applicant identified AMR line items for which the aging review process identified no aging effects. Specifically, the applicant stated that it identified no aging effects for (1) components fabricated from various insulating materials (e.g., Phenolic or Melamine) exposed to heat and radiation environments and (2) components fabricated from copper, brass, and steel material exposed to thermal cycling, vibration, electrical transients, mechanical stresses, corrosion, chemical contamination, and oxidation environments.

<u>Components Fabricated from Various Insulating Materials such as Phenolic or Melamine Exposed to Heat or Radiation</u>. The average temperature where fuse holders are located is 85 °F and the radiation exposure is 1.11×10^5 Rads. These temperature and radiation levels are less than the insulating material 60-year service-limiting temperature of 205 °F and radiation dose of 5×10^7 Rads. Operating experience demonstrates no aging effect when insulating materials such as Phenolic or Melamine are exposed for 60 years at a service-limiting temperature of 205 °F and radiation dose of 5×10^7 Rads. No aging effects are considered applicable for components fabricated from various insulating materials (e.g., Phenolic or Melamine) exposed to heat and radiation environments.

On the basis of its review of current industry research and operating experience, the staff found that heat and radiation on various insulating materials like Phenolic or Melamine will not result in aging that will be of concern during the period of extended operation. The applicant's fuse holders are not exposed to temperatures at which operating experience demonstrates aging effects of embrittlement, cracking, melting, or discoloration; therefore, the staff concluded that insulating materials such as Phenolic or Melamine exposed to heat and radiation environments have no applicable AERMs.

<u>Components Fabricated from Copper, Brass, and/or Steel Exposed to Thermal Cycling, Vibration, Electrical Transients, Mechanical Stress, Corrosion, Chemical Contamination, or Oxidation.</u>

<u>Effect of thermal cycling</u>—Thermal cycling is an aging effect associated with power circuit operations. Operating low-current fuse holders below the design-current rating will eliminate the aging effect of thermal cycling. Typically, control fuse holders are rated far in excess of the fuse rating. The fuse will limit the current to values well below the rating of the fuse holder. The low current values experienced by control circuits typically do not create thermal cycling effects. No aging effects are considered to apply to components fabricated from copper, brass, and/or steel material exposed to a thermal cycling environment.

On the basis of its review of current industry research and operating experience, the staff found that thermal cycling on copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Fuse holders at MNGP are low current, and operating experience shows that low currents do not create thermal cycling effects; therefore, the staff concluded that copper, brass, and/or steel components exposed to a thermal cycling environment have no applicable AERMs.

<u>Effect of vibration</u>—Vibration is a result of rapid mechanical movement about a specific point at an elevated frequency. Fuse holders at MNGP are mounted on rigid walls and are not subject to vibration. No aging effects are considered applicable to components fabricated from copper, brass, and/or steel material exposed to a vibration environment.

On the basis of its review of current industry research and operating experience, the staff found that vibration on the fuse holder's metallic clamp fabricated from copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Fuse holders at MNGP are mounted on rigid walls and not subject to vibration; therefore, the staff concluded that copper, brass, and/or steel components exposed to a vibration environment have no AERMs.

<u>Effect of electrical transients</u>—Electrical transients of power applications (i.e., large-surge current transformers and power cables) create aging effects. These transients affect the insulation of the device and if sufficiently frequent may weaken the insulation over time. Fuse holders subject to an AMR at MNGP provide electrical power to fire detection components. These components are low-voltage and low-current applications. No aging effects are considered applicable to components fabricated from copper, brass, and/or steel material exposed to electrical transients.

On the basis of its review of current industry research and operating experience, the staff found that electrical transients on copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Electrical transients in the low-current application of fuse holders at MNGP are not sufficient to cause aging effects; therefore, the staff concluded that copper, brass, and/or steel components exposed to an electrical transient environment have no applicable AERMs.

Effect of mechanical stress—Frequent manipulation is a result of removing and reinstalling the fuse from the fuse holder in a frequent time period. Aging effects resulting from frequent manipulation have a correlation to fatigue. Fuse holders at MNGP have no fuses removed and reinstalled on a frequent basis. No aging effects are considered applicable to components fabricated from copper, brass, and/or steel material exposed to a mechanically stressful environment.

On the basis of its review of current industry research and operating experience, the staff found that mechanical stress on copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Fuses at MNGP are not frequently removed and installed; therefore, the staff concluded that copper, brass, and/or steel components exposed to a mechanically stressful environment have no applicable AERMs.

Effect of corrosion, chemical contamination, and oxidation—The aging stressors chemical contamination, corrosion, and oxidation are related to environments in which chemical water vapors create adverse localized environments. The indoor air environment is a controlled, mild environment with no significant concentrations of chemical vapors and moisture to create an adverse environment. Fuse holders at MNGP operate in an indoor air environment. No aging effects are considered applicable to components fabricated from copper, brass, and/or steel material exposed to chemical contamination, corrosion, and oxidation environments.

On the basis of its review of current industry research and operating experience, the staff found that chemical contamination, corrosion, and oxidation on copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Fuse holders at MNGP are protected from moisture and chemical contamination. Therefore, the staff concluded that copper, brass, and/or steel components exposed to chemical contamination, corrosion, and oxidation environments have no applicable AERMs.

The staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience determined that the applicant demonstrated that the effects of aging for fuse holders will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3.3 Electrical Components—Non-EQ Cables and Connections Commodity Group—Summary of Aging Management Evaluation—Table 3.6.2-3

The staff reviewed LRA Table 3.6.2-3, which summarizes the results of AMR evaluations for the non-EQ cables and connections commodity group component groups.

In LRA Table 3.6.2-3, the applicant stated that it identified no aging effects for components fabricated from various metal materials exposed to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation environments. As supported by SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants—Electrical Cable and Terminations," issued September 1996, and the applicant's operating experience, the likelihood of substantially increased effects or failure rates is considered low from thermal cycling, ohmic heating, electrical transients, mechanical stress (vibration), chemical contamination, corrosion, and oxidation. No aging effects are considered applicable to components fabricated from various metal materials exposed to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation environments.

The staff noted that operating experience shows loosening of metallic parts of cable connections. Review of several licensee event reports revealed loose connections due to corrosion, vibration, thermal cycling, and other factors. In RAI 3.6-2, dated November 7, 2005, the staff requested that the applicant provide technical justification for not providing an AMP for cable connections.

In its response, by letter dated December 7, 2005, the applicant stated that SAND96-0344 categorizes aging mechanisms as either "significant" or "significant and observed." According to SAND96-0344, the aging mechanism listed is "significant."

Section 4.2 of SAND96-0344 emphasizes that "the applicability of some aging mechanisms to actual cable systems (cable and connections) may be very limited or the frequency of their occurrence may be extremely low." After a consideration of all stressors and the reported incidence of their effects in the industry, SAND96-0344 concluded the following:

> ...the likelihood of substantially increased effects or failure rate resulting from aging mechanisms currently categorized only as 'significant' is considered low.

This assessment, which is based on industry-wide observations, provides reasonable assurance that these aging mechanisms will cause no loss of intended function if left unmanaged during the period of extended operation. Based on the above, the applicant stated that industry and plant-specific operating experience does not support the presence of aging effects from thermal cycling, ohmic heating, electric transients, vibration, chemical contamination, corrosion, and oxidation on the metallic parts of cable connections.

In a January 12, 2006, teleconference, the staff informed the applicant that its justification for not having an AMP for cable connections was inadequate because the operating experience shows loosening of metallic parts of cable connections. The staff recommended that the applicant implement an AMP for the metallic parts of cable connections in accordance with GALL AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The applicant stated that it had implemented a plant-specific thermography program for equipment that presents a significant risk to core protection, is necessary to maintain full power production, or has the potential to reduce power. This equipment, monitored at least semiannually, includes but is not limited to substation equipment, 4-kV breakers, load centers, motor control centers, control centers, control panels, direct current equipment, motors, or generators. The licensee stated that it will consider expanding the current thermography program to include cable connectors and switchyard bus connections as well as transmission conductor connections that are within the scope of license renewal.

In its letter dated February 28, 2006, the applicant committed to implementing a new program consistent with GALL AMP XI.E6, documented as commitment 55 in Table A.5. The staff found this response acceptable, as it will provide assurance that the effects of aging on electrical connections will be adequately managed. Therefore, the staff's concern described in RAI 3.6-2 is resolved.

On the basis of the staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience, the staff determined that the applicant demonstrated that the effects of aging for non-EQ cables and connections will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3.4 Electrical Components—Offsite Power/Station Blackout Recovery Path Commodity Group—Summary of Aging Management Evaluation—Table 3.6.2-4

The staff reviewed LRA Table 3.6.2-4, which summarizes the results of AMR evaluations for the offsite power/SBO recovery path commodity group component groups.

The applicant proposed to manage embrittlement, cracking, discoloration, oxidation, and loosening of bolted connections for nonsegregated phase bus made from various metals and organic polymers, porcelain, fiberglass, and silicon rubber in an indoor and outdoor air environment using the Bus Duct Inspection Program. SER Section 3.0.3.3.1 documents the staff evaluation of the Bus Duct Inspection Program.

Nonsegregated Phase Bus

A nonsegregated phase bus connects two or more elements of an electrical power circuit and is normally used to connect active electrical components such as generators, breakers, and transformers. The intended function of a nonsegregated phase bus is to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals.

The applicant has identified the Bus Duct Inspection Program to manage aging effects in the nonsegregated phase bus. SER Section 3.0.3.3.1 documents the staff evaluation of the Bus Duct Inspection Program.

High-Voltage Insulators

In LRA Table 3.6.2-4, the applicant stated that it identified no aging effects for high-voltage insulators fabricated from porcelain, cement, and metal material exposed to an outdoor air environment.

Effect of surface contamination on porcelain—The applicant stated that MNGP is located in a rural area not close to saltwater environments. The nearest industrial facility discharging any significant amount of airborne particulates is about 5 miles northwest of the plant. Since the plant began operation in 1971, plant personnel have not conducted regularly scheduled maintenance to remove surface contamination from the switchyard or transmission line insulators. Additionally, operating experience indicates no age-related degradation of the high-voltage insulators from surface contamination. No aging effects are considered applicable to components fabricated from porcelain material exposed to an outdoor air environment.

On the basis of its review of current industry research and operating experience, the staff found that porcelain in an outdoor air environment will not result in aging that will be of concern during the period of extended operation. The applicant's high-voltage insulators are not located in an area subject to airborne contaminants. Therefore, the staff concluded that porcelain components exposed to an outdoor air environment have no AERMs.

Effect of cracking on porcelain—Cracks have also been known to occur in insulators used in strain applications when the cement that binds the parts together expands enough to crack the porcelain. This phenomenon, known as cement growth, is caused by improper manufacturing process or materials that increase the cement's susceptibility to moisture penetration. Porcelain cracking caused by cement growth has occurred only in isolated bad batches of insulators used in strain applications. The dates of manufacture and brands of these problem insulators are known and they have been removed from service. Cracking is not considered applicable to components fabricated from porcelain and cement material exposed to an outdoor air environment.

On the basis of its review of current industry research and operating experience, the staff found that porcelain and cement in an outdoor air environment will not result in aging that will be of concern during the period of extended operation. Operating experience using properly manufactured cement shows no aging effects. Therefore, the staff concluded that porcelain and cement components exposed to an outdoor air environment have no applicable AERMs.

Effect of loss of material due to wear—Loss of material due to mechanical wear is an aging effect for strain and suspension insulators if they are subject to significant movement. Although this mechanism is possible, experience shows that transmission conductors do not normally swing, and when they do, because of strong winds, they dampen quickly once the wind subsides. Routine inspections of high-voltage insulators have not identified wear, and loss of material due to wear is not considered applicable for components fabricated from metal material exposed to an outdoor air environment.

On the basis of its review of current industry research and operating experience, the staff found that metal in an outdoor air environment will not result in loss of material due to wear that will be of concern during the period of extended operation. Transmission conductors and high-voltage insulators are not subject to significant movement; therefore, the staff concluded that metal components exposed to an outdoor air environment have no applicable AERMs.

The staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience determined that the applicant had demonstrated that the effects of aging for high-voltage insulators will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

High-Voltage Switchyard Bus

In LRA Table 3.6.2-4, the applicant stated that it identified no aging effects for high-voltage switchyard buses fabricated from aluminum and steel material exposed to an outdoor air environment.

Effect of vibration on switchyard bus—Switchyard buses connected to flexible conductors that normally do not vibrate are supported by insulators and ultimately by static, structural components like concrete footings and structural steel. With no connections to moving or vibrating equipment, vibration is not an applicable stressor. No aging effects are considered to be applicable to components fabricated from aluminum and steel exposed to outdoor air and vibration environments.

On the basis of its review of current industry research and operating experience, the staff found that outdoor air and vibration of aluminum and steel will not result in aging that will be of concern during the period of extended operation. Switchyard bus is not subject to vibration. Therefore, the staff concluded that for aluminum and steel components exposed to outdoor air due to vibration have no applicable AERMs.

Effect of oxidation on switchyard bus and connections—All switchyard bus connections within the offsite power/SBO recovery path boundaries are bolted, welded, or, for jumper cables, crimped aluminum connections. Aluminum bus, solid and flexible connectors, and ground straps are highly conductive but do not make good contact surfaces as aluminum exposed to air forms nonconductive aluminum oxide on the surface. To prevent formation of aluminum oxide, the connections are cleaned with a wire brush (to remove existing aluminum oxide) and covered with No-Ox grease to prevent air from contacting the aluminum surface. After the connection is completed, additional compound is applied and forced into every irregularity and opening to seal the joint completely against moisture and corrosion. The grease prevents oxidation of the aluminum surface, thereby maintaining good conductivity at the bus connections. The grease is a consumable that is replaced during bus routine maintenance. Routine maintenance thermography inspections monitor substation connections, which include the SBO recovery path equipment connections, on a semiannual basis. These inspections identify connections where conditions exist that have resulted in increased resistance and a subsequent rise in temperature. The applicant schedules the inspections in the work control process and performs them on a repetitive basis as part of routine maintenance. The inspections have been effective in identifying conditions before any loss of the component intended function. Oxidation is not considered applicable to components fabricated from aluminum and steel exposed to outdoor air.

On the basis of its review of current industry research and operating experience, the staff found that aluminum and steel in an outdoor air environment will not result in aging that will be of concern during the period of extended operation. The application of grease and its periodic replacement eliminates the effects from air on switchyard bus connections. In addition, the applicant periodically inspects connections using thermography. Therefore, the staff concluded that aluminum and steel components exposed to an outside air environment have no applicable AERMs.

High-Voltage Transmission Conductors

In LRA Table 3.6.2-4, the applicant stated that it identified no aging effects for high-voltage transmission conductors fabricated from aluminum and steel material exposed to an outdoor air environment.

Effect of loss of conductor strength due to corrosion—For transmission conductors, degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles chemistry, sulfur dioxide concentration in air, precipitation, fog chemistry, and meteorological conditions. Corrosion of transmission conductors is a very slow process that is even slower in rural areas with generally fewer suspended particles and sulfur dioxide concentrations in the air than urban areas. MNGP is located in a rural area with low airborne particle and sulfur dioxide concentrations. No aging effects are considered applicable to components fabricated from aluminum and steel exposed to outdoor air.

On the basis of its review of current industry research and operating experience, the staff found that aluminum and steel in an outdoor air environment will not result in aging that will be of concern during the period of extended operation. Corrosion is a slow process and is slower in rural areas, where MNGP is located. Therefore, the staff concluded that loss of conductor strength due to corrosion is not an applicable AERM for aluminum and steel components exposed to an outside air environment.

Effect of vibration—Wind loading can cause transmission conductor vibration. Wind loading is considered in the initial design and field installation of transmission conductors and high-voltage insulators throughout the transmission and distribution network. Loss of material due to wear and fatigue that could be caused by transmission conductor vibration or sway is not considered an applicable aging effect because experience throughout the industry shows no significant failures of this type. No aging effects are considered applicable to components fabricated from aluminum and steel material exposed to an outdoor air environment.

On the basis of its review of current industry research and operating experience, the staff found that aluminum and steel in an outdoor air environment will not result in aging that will be of concern during the period of extended operation. There is no operating experience for failure of transmission conductors due to vibration. Therefore, the staff concluded that vibration will not result in any applicable AERMs for aluminum and steel components exposed to an outside air environment.

Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements

SER Section 3.6.2.3.3 documents the staff evaluation for this area.

The staff's review of the applicant's programs, the aging effects, and the plant-specific and industry operating experience determined that the applicant had demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concluded that they adequately describe the AMPs credited for managing aging of the electrical and I&C components, as required by 10 CFR 54.21(d).

3.7 Conclusion for Aging Management Review Results

The staff reviewed the information in LRA Section 3 and Appendix B to the LRA. On the basis of its review of the AMR results and AMPs, the staff concluded that the applicant has demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable USAR supplement program summaries and concluded that the USAR supplement adequately describes the AMPs credited for managing aging, as required by 10 CFR 54.21(d).